PB84-108703

Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192). Volume 2

(U.S.) Office of Radiation Programs
Washington, DC

Sep 83

U.S. Department of Commerce
National Technical Information Service
NTIS

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA-520/1-83-008-2	2.	3. RECIPIENT'S ACCESSION NO. PB84 108703
4. TITLE AND SUBTITLE Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192) Vol. II		5. REPORT DATE September 1983
		6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S)		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Same as box 12.		10. PROGRAM ELEMENT NO.
		11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS U.S. Environmental Protection Agency 401 M Street, S.W. Washington, D.C. 20460		13. TYPE OF REPORT AND PERIOD COVERED
		14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

16. ABSTRACT

This part of the Final Environmental Imapct Statement (FEIS), Volum II, presents responses to written and oral comments submitted to the Agency on the proposed standards for the control of byproduct materials from uranium ore processing. It also addresses comments on the Draft Environment Impact Statement (DEIS) and the Regulatory Impact Analysis (RIA). This volume includes summarized comments and responses for comments received by the Central U.S. Environmental Protection Agency Docket as of July 14, 1983.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group

18. DISTRIBUTION STATEMENT unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES 232
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE

PB84-108703

United States
Environmental Protection
Agency

Office of
Radiation Programs
Washington, DC 20460

September 1983
EPA 520/1-83-008-2

Radiation

EPA

Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192)

Volume II

REPRODUCED BY
NATIONAL TECHNICAL
INFORMATION SERVICE
U.S. DEPARTMENT OF COMMERCE
SPRINGFIELD, VA 22161

EPA 520/1-83-008-2

Final
Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192)

Volume II

September 1983

Office of Radiation Programs
U.S. Environmental Protection Agency
Washington, D.C. 20460

FINAL ENVIRONMENTAL IMPACT STATEMENT FOR STANDARDS FOR CONTROL OF BYPRODUCT MATERIALS FROM URANIUM ORE PROCESSING (40 CFR 192): RESPONSE TO COMMENTS

TABLE OF CONTENTS

Page No.

FREQUENTLY USED ABBREVIATIONS v
FREQUENTLY USED REFERENCES vii
I. INTRODUCTION 1
II. MISCELLANEOUS LETTERS 5
III. COMMENTS ON THE PROPOSED STANDARDS 7

A. 40 CFR PART 192, SUBPART D - STANDARDS FOR URANIUM BYPRODUCT MATERIALS

1.0 SCOPE OF THE STANDARDS, THE DEIS, AND THE RIA A.1-1
  1.1 Coverage of the Standards, the DEIS, and the RIA A.1-1
  1.2 Form of the Standards A.1-16
  1.3 Definitions A.1-20
  1.4 Responsibilities of the EPA and the NRC A.1-22

2.0 RISK ASSESSMENT A.2-1
  2.1 Radiological Health Risk Assessment A.2-7
    2.1.1 Exposure Pathways A.2-21
    2.1.2 Risk Models A.2-23
  2.2 Nonradiological Health Risk Assessment A.2-36
    References A.2-37

3.0 RATIONALE FOR STANDARDS A.3-1
  3.1 Basis for Standards A.3-1
  3.2 Benefits/Risk Reduction A.3-1
  3.3 Costs Estimates A.3-17
  3.4 Cost Effectiveness A.3-33
  3.5 Population Density-Dependent Standards A.3-38
    References A.3-40

4.0 STANDARDS FOR OPERATIONS A.4-1
  4.1 Design and Operating Requirements for Surface Impoundments (liner requirements, 40 CFR 264.221) A.4-3
  4.2 Groundwater Protection A.4-15
    4.2.1 Standards (40 CFR 264.92) A.4-18
    4.2.2 Hazardous Constituents (40 CFR 264.93) A.4-29
    4.2.3 Concentration Limits (40 CFR 264.94) A.4-33
    4.2.4 Point of Compliance (40 CFR 264.95) A.4-36
    4.2.5 Compliance Period (40 CFR 264.96) A.4-38
    4.2.6 Corrective Action Programs A.4-40
  4.3 Surface Water Protection (40 CFR 440) A.4-42
  4.4 Control of Radon Releases A.4-45
  4.5 Dose Limits Other than from Radon Emissions (40 CFR 190) ... A.4-49

TABLE OF CONTENTS (Continued)

Page No.

5.0 STANDARDS FOR DISPOSAL A.5-1
  5.1 Period of Effectiveness (Longevity) A.5-19
  5.2 Radon Emission Limit A.5-25
  5.3 Radium-226 Soil Concentration Exemption (40 CFR 192.32(b)(2)) A.5-33

6.0 IMPLEMENTATION A.6-1
  6.1 Standards for Operation A.6-1
  6.2 Standards for Disposal A.6-2
  6.3 Supplemental Standards A.6-4

7.0 MISCELLANEOUS COMMENTS A.7-1

B. 40 CFR PART 192, SUBPART E - STANDARDS FOR THORIUM BYPRODUCTS MATERIALS

1.0 SCOPE OF THE STANDARDS, THE DEIS, AND THE RIA B.1-1
  1.1 Coverage of the Standards, the DEIS, and the RIA B.1-1
  1.2 Definitions B.1-3
  1.3 Responsibilities of the EPA and the NRC B.1-4

2.0 RISK ASSESSMENT B.2-1
  2.1 Radiological Health Risk Assessment B.2-1

3.0 RATIONALE FOR STANDARDS B.3-1
  3.1 Basis for Standards B.3-1

4.0 STANDARDS FOR OPERATIONS B.4-1
  4.1 Design and Operating Requirements for Surface Impoundments (liner requirements, 40 CFR 264.221) ... B.4-2
  4.2 Groundwater Protection B.4-3
    4.2.1 Standards (40 CFR 264.92) B.4-3
    4.2.2 Hazardous Constituents (40 CFR 264.93) B.4-4
    4.2.3 Concentration Limits (40 CFR 264.94) B.4-5
  4.3 Surface Water Protection (40 CFR 440) B.4-6
  4.4 Control of Radon Releases B.4-7

5.0 STANDARDS FOR DISPOSAL B.5-1
  5.1 Period of Effectiveness (Longevity) B.5-2

6.0 MISCELLANEOUS COMMENTS B.6-1

TABLE OF CONTENTS (Continued)

Page

APPENDIX

Submittals -- EPA's Docket A-82-26-VI-D List
with Commenter Affiliation Identifiers

Table C-1--Written Submittals, Grouped by Affiliation C-1

Table C-2--Public Hearings, Grouped by Affiliation C-14

FREQUENTLY USED ABBREVIATIONS

AEA	Atomic Energy Act
AEC	Atomic Energy Commission
Agency	U.S. Environmental Protection Agency
ALARA	As Low As Reasonably Achievable
AMC	American Mining Congress
BEIR Committee	Biological Effects Ionizing Radiation Committee of the National Academy of Sciences
CFR	Code of Federal Regulations
CWLM	Cumulative WLM
EDF	Environmental Defense Fund
DEIS	Draft Environmental Impact Statement
DOE	U.S. Department of Energy
DOE/EIA	U.S. Department of Energy/Energy Information Administration
EPA	U.S. Environmental Protection Agency
FEIS	Final Environmental Impact Statement
ICRP	International Commission on Radiation Protection
NAS	National Academy of Sciences
NCRP	National Council for Radiation Protection and Measurements
ND	No data available
UNSCEAR	United Nations Committee on the Effects of Atomic Radiation
NRC	U.S. Nuclear Regulatory Commission
RCRA	Resource Conservation and Recovery Act (also SWDA)
RIA	Regulatory Impact Analysis
SWDA	Solid Waste Disposal Act (also RCRA)
UMTRCA	Uranium Mill Tailings Radiation Control Act
USC	U.S. Congress
U.S.H.R.	U.S. House of Representatives
WLM	Working Level Month

FREQUENTLY USED REFERENCES

AEA 83	U.S. Congress, Clean Air Act, Public Law 90-148, 42 USC 7401 et. seq., 1967.
CAA 81	U.S. Congress, Clean Air Act, Public Law 97-23, 42 USC 7401, 1981.
SWDA	U.S. Congress, Solid Waste Disposal Act (Reference is to the Act as amended by RCRA) Public Law 94-580, 42 USC 3251 et. seq., 1976.
RCRA 76	U.S. Congress, Resource Conservation and Recovery Act, Public Law 94-580, 42 USC 6901 et. seq., 1976. Amends Solid Waste Disposal Act (SWDA).
RCRA 82	U.S. Congress, Resource Conservation and Recovery Act, Public Law 97-272 as amended, 42 USC 6901, 1982.
UMTRCA 78	U.S. Congress, Uranium Mill Tailings Radiation Control Act, Public Law 95-604, 42 USC 7901, 1978.
UMTRCA "as amended"	U.S. Congress, Nuclear Regulatory Commission Authorization Act of 1982, Public Law 97-415, January 1983.
DEIS-I	EPA, Draft Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192), EPA 520/4-80-011, 1982.
FEIS-I, Volume I	EPA, Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192), Volume I, EPA 520/4-82-013-1, October 1982.
FEIS-I, Volume II	EPA, Final Environmental Impact Statement for Remedial Action Standards for Inactive Uranium Processing Sites (40 CFR 192), Volume II, EPA 520/4-82-013-2, October 1982.
DRIA 83	EPA, Draft Regulatory Impact Analysis of Environmental Standards for Uranium Mill Tailings at Active Sites, EPA 520/1-82-023, March 1983.
RIA 83	EPA, Regulatory Impact Analysis of Final Environmental Standards for Uranium Mill Tailings at Active Sites, EPA 520/1-83-010, September 1983.
DEIS	EPA, Draft Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192), EPA 520/1-82-022.

FEIS, Volume I	EPA, Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192), Volume I, EPA 520/1-83-008-1, September 1983.
Preamble	Preamble to the Final Environmental Impact Statement (FEIS, Volume I) for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192), EPA 520/1-83-001, September 1983.

RESPONSE TO COMMENTS

I. INTRODUCTION

This part of the Final Environmental Impact Statement (FEIS), Volume II, presents responses to written and oral comments submitted to the Agency on the proposed standards for the control of byproduct materials from uranium ore processing. It also addresses comments on the Draft Environment Impact Statement (DEIS) and the Regulatory Impact Analysis (RIA). Proposed Standards for Uranium and Thorium Mill Tailings at Licensed Commercial Processing Sites were issued on April 29, 1983 (48 FR 19584). The Draft Environmental Impact Statement was issued in March 1983. Public hearings on the proposed standards were held in Washington, D.C., May 31, 1983, and in Denver, Colorado, June 15 and 16, 1983.

This volume includes summarized comments and responses for comments received by the Central U.S. Environmental Protection Agency Docket as of July 14, 1983. All written comments and hearing transcripts are available for review in Docket No. A-82-26, IV-D, located in the U.S. Environmental Protection Agency, 401 M. Street, S.W., West Tower Lobby, Gallery One, Washington, D.C. 20460.

The method used in responding to comments was to assign comments to general topic categories. Commenters were assigned an affiliation/submittal identifier. Comments addressing the standards were identified, summarized, and assigned to the appropriate topic category. Within each category, comments of common concern were consolidated, where possible, into a composite comment that could be addressed by a single response. Most responses are intentionally brief and make reference to the DEIS, and RIA, or supporting reference when more detailed technical information is appropriate. Where an adequate response required it, however, a more lengthy discussion of the technical considerations relevant to the comment is presented. We did not respond to a few comments which indicated only general agreement or disagreement with the DEIS or standards and which were not accompanied by any supporting data or arguments.

This procedure avoids, as much as possible, duplication of comments and responses and aids finding a response according to its topic. In Section III we attempted to summarize only comments addressing the proposed standards, although comments addressing related areas may occasionally appear.

Each comment is followed by a code letter/numbers identifying: (1) the commenter and its affiliation; (2) the origin of the submittal (written or from the Public Hearing); and (3) the number of the comment within a submittal, since when a commenter made more than one submittal, these were sequentially numbered. Table 1 explains the identifiers' code and is followed by an example on how to interpret the identifiers.

An index of the commenters with identifiers of their affiliation and of their submittal appears in the Appendix, Tables C-1, C-2.

The Final Standards, referenced to as 40 CFR 192, are in Appendix A in Volume I of the FEIS.

TABLE 1

CODE LETTER NUMBERS

Identifiers

(i)	A	Refers to comments on Uranium Standards
	B	Refers to comments on Thorium Standards
(2)	P	Member of the public, public interest groups, and the scientific community
	I	Industry
	F	Federal agency
	S	State or local government
(3)	H1	Refers to the public hearing, held in Washington, D.C., on May 31, 1983.
	H2	Refers to the public hearing held in Denver, Colorado, on June 15 and 16, 1983.
(4)	(i)	A number in parentheses refers to the sequence in which the submittals were received when more than one submittal was received from one commenter.
(5)		For commenters' affiliation identifiers, consult Tables C-1 and C-2 (Appendix).
(6)		Full identifiers have meaning only in conjunction with the Outline of Topics (see Table of Contents, Section III).

Example for interpreting a code letter/number

Identifier: I-6(3).5

I refers to a commenter from industry

6 refers to the 6th industrial member with its first written submittal to docket No. A-82-26,IV-D

(3) refers to the 3rd written submittal by this commenter.

5. refers to the number of the comment in sequentially numbered comments, when more than one comment has been identified in a submittal.

II. MISCELLANEOUS LETTERS

Letters requesting extension of the comment periods, letters requesting that the respondents be scheduled to present testimony during the public hearings, and other miscellaneous requests or statements have been addressed in this section.

Miscellaneous Requests

Extension of Comment Period

1. We request that the Agency extend its written comment period for 30 days. (P-1.1, P-3.1, F-3.1, F-4.1, I-4.1, I-5.1, I-6.1, I-7.1, I-8.1, I-9.1, I-10.1, I-12.1, P-5(1).1).

2. We request that EPA extend its written comment period 45 days. (S-2.1)

3. We request that EPA extend its written comment period 60 days. (I-1.1, I-2.1)

4. We request additional time, beyond the May 31 deadline, to prepare comments (no time period specified). (I-3.1, I-15.1)

Response: The period for written comments was extended to June 14, 1983, and an additional hearing was held on June 15-16, 1983, in Denver, Colorado. The hearing record was held open for written submissions until June 30, 1983. In effect, EPA extended the period for written comments by one month.

III. COMMENTS ON THE PROPOSED STANDARDS
(40 CFR Part 192, Subparts D & E)

This Section presents the summarized and consolidated comments, and the responses to these comments. The comments were categorized according to the Outline of Topics (Table of Contents, Section III).

Comments were categorized by the commenter's identification and by topic, as described in Section I. Occasionally a comment may appear in more than one category. Comments that logically fit into a more general category, such as 3.1, Basis for Standards, but address a more specific area, for example, basis for groundwater standards, will more likely appear under the specific subcategory, such as 4.2.1 Groundwater Protection - Standards (40 CFR 264.92).

As much as feasible, comments within a subtopic have been grouped according to the issue they address. The outline of the issue appears as a subheading (in italics) above each such group of comments.

40 CFR PART 192, SUBPART D - STANDARDS FOR URANIUM BYPRODUCT MATERIALS

A.1.0 SCOPE OF THE STANDARDS, THE DEIS, AND THE RIA

A.1.1 Coverage of the Standards, the DEIS, and the RIA

!The Nonradiological Portions of the Standard Are Not Authorized!

Comment 1: In the Preamble to its proposed standards (p. 19592), EPA states that Congress in UMTRCA78 exempted uranium mill tailings from the hazardous waste regulatory system of Subtitle C of the SWDA. Then it argues that Congress "could not have meant" what it said. We find EPA's reasoning to be convoluted at best. (I-9(2).1, I-4(3).78)

Response: In support of the contention that EPA lacks authority to set groundwater standards for active mills, commenters argued that Subtitle C of the SWDA does not apply to exempted materials, and is therefore "inapplicable" to the hazards associated therewith; and, relatedly, that standards "consistent" with Subtitle C standards cannot mean standards "identical" to Subtitle C standards because Congress could have specified "identical" standards if it wanted to.

EPA considers that Congress could not have self-defeatingly required standards "consistent" with Subtitle C if Subtitle C required no standards because the SWDA generally exempts "byproduct material" regulated under the Atomic Energy Act. Congress manifestly desired to assure a comprehensive scheme of "protection" of health and the environment, while avoiding duplicative regulation under SWDA and the Atomic Energy Act through permits and license requirements that addressed different facets of the same materials. This differentiation between goals -- protection against the hazards addressed by the SWDA -- and means helps to effectuate comprehensive protection. In contrast, the interpretation proposed by the commenters would subvert Congress' plan by leaving unaddressed a significant source of hazard to the environment and public health.

The interpretation that "consistent" cannot mean "identical" appears to assume that the only alternative interpretation is that Congress limited EPA's authority in the self-defeating fashion described above. As we just explained, that is not the only interpretation. EPA explained in the Preamble, moreover, that Congress may also have intended to provide EPA some latitude to adapt SWDA requirements when and where the particular nature of the hazard warranted.

!EPA Should Not Continue with the Nonradiological Portions of this Rulemaking!

Comment 2: EPA's proposal to impose nondegradation and Table 1 standards of 40 CFR 264.92-94 on uranium processing facilities directly contravenes Section 275(b) of the Atomic Energy Act, Section 7 of SWDA, and the intent of Congress. The SWDA standards which EPA proposes to apply to uranium processing were developed for hazardous waste facilities, not mineral extraction industries as required. Thus, EPA either must wait for groundwater standards to be developed for the mineral extraction industry under the SWDA, or develop and justify proposed standards under its Atomic Energy Act authority. (I-2(2).2, I-2(2).4, I-5(2).6, I-6(3).57, I-4(3).74, I-20.3, I-22.12, I-4(3).76, I-4(3).75, I-7(2).3, I-22.3, I-4(3).81, I-4(3).80, I-4(3).77, I-4(3).8, I-30.6, I-30.7, I-2(2).1, I-22.15, I-25.1, I-19.10, I-9(2).2)

Response: While the SWDA standards apply to hazardous waste management facilities it does not follow that EPA is without authority to set UMTRCA standards consistent with such SWDA standards because such UMTRCA standards would apply to "mineral extraction operators." Mineral extraction in this case of uranium results in waste which Congress intended be "managed," i.e., controlled and disposed of. The fact that other portions of the mineral extraction industry have not yet been addressed under SWDA does not alter the fact that Congress has directed EPA to establish standards for this part of the mineral extraction industry comparable to Subtitle C standards. Congress interposed no requirement that other segments of the mineral extraction industry be addressed first nor did it require sub silentio that the UMTRCA standards be consistent with only a portion of Subtitle C standards. EPA explained the basis for its selection of surface impoundment regulations as the SWDA regime most analogous to uranium tailings piles, and has made due allowance for the relevant differences between such impoundments and such tailings piles, (48 Federal Register 19592). Nothing in UMTRCA or other laws bars EPA from proceeding by analogy to surface impoundments so long as the analogy itself is, as EPA believes, reasonable.

The fact that uranium wastes are comparatively speaking, isolated high volume low toxicity wastes does not invalidate the analogy to surface impoundments or warrant deferral of regulation in defiance of Congressionally imposed deadlines. It remains important to protect groundwater, assure proper disposal of the waste and to protect existing and future populations. The further fact that Congress has deferred regulation of some mining wastes pending a study of the hazards associated therewith might change this if the relevant 1980 amendments, 42 US (6921(b)(3)) impliedly amended Section 275(b). Implied amendments are, of course, disfavored. Considering that Congress expressly amended UMTRCA in 1982 but made no effort to limit or revise EPA's authority to address groundwater protection, EPA's interpretation can hardly be considered unreasonable.

Finally, the UMTRCA simply requires that these standards protect against the hazards consistently with SWDA standards, not against the sources of the hazards.

Comment 3: We do not believe that an engineering design standard as proposed in this rule would be appropriate for application to phosphogypsum from the phosphate fertilizer industry. (I-32.2)

Response: This rulemaking does not apply to the phosphate fertilizer industry.

!*Additional Operations Should Be Covered by the Standards*!

Comment 4: EPA should address water and radon impacts from in-situ mining and propose appropriate standards. (S-6.5)

Response: We noted in the Preamble to the final rules that groundwater is protected from in situ mining by the Underground Injection Control Program promulgated under Sections 1421 and 1422 of the Safe Drinking Water Act (regulations codified in 40 CFR 144, 145, and 146), and implemented in either EPA or approved State programs. Radon impacts from above ground wastes are covered under the UMTRCA Standards.

Comment 5: The standard should include control of waste rock, overburden, and low grade ores as these are recognized hazardous wastes. (P-8(H1).8, S-3(2).2)

Response: UMTRCA directs EPA to set standards for ore processing wastes. An EPA report on the hazards of uranium mining wastes and recommendations for their control was sent to Congress in June 1983, (Potential Health and Environmental Hazards of Uranium Mine Wastes, EPA/1-83-007). Regulations for uranium mine wastes will be considered in a separate rulemaking, if required.

Comment 6: The standard should address the cleanup of contaminated off-site locations, particularly where tailings from active piles have been used as construction material. (S-3(2).1)

Response: We believe that the Standards (40 CFR 192, Subpart B) we have already published for the off-site cleanup program for inactive mills under Title 1 of UMTRCA would be suitable for application to off-site contamination from active mills.

Comment 7: The standards should require programs to reclaim contaminated areas in the vicinity of operating mills. (P-15(H2).5)

Response: See the response to Comment 6, A.1.1. We believe that cleanup near active mills is an area for NRC and Agreement States to address.

Comment 8: The standard should address dusting from piles to control contamination of adjacent land. (S-3(H2).1, P-13(2).3)

Response: The standard contains provisions for the operational (Sections 192.32 (a)(3) and 192.32(a)(4)) and post-closure (Section 192.32(b)) periods that will control dusting.

Comment 9: Regulations do not consider technologies still to be developed. How will they be regulated? (P-8(H1).21)

Response: These standards take account of the current technological state-of-the-art. If new control technologies are developed that warrant changes in the standards, EPA has the authority to modify the standards accordingly.

Comment 10: All new tailings should be disposed of as required by the rule, regardless of whether they are generated at new or existing facilities. (P-3(2).4)

Response: The only difference in the rule for new and existing facilities involves the liner requirement, which applies only for new or laterally expanded impoundments. Application of the secondary standard to remaining wastes is discussed in the Preamble.

!*Application to Non-arid Regions Should be Specified*!

Comment 11: EPA assumes a 5-year drying out period for the tailings. How are the tailings going to dry out in Virginia? (P-5(H1).10)

Response: We have acknowledged that most of our experience with tailings relates to relatively arid regions in the West where the uranium milling industry has operated in the United States. The "dry out" period is an analytical assumption, not a regulatory requirement. The purpose of a "dry out" period is to facilitate disposal operations. If uranium is to be milled in the East, other techniques may have to be applied, such as dewatering methods, in order to prepare the tailings for disposal.

Comment 12: The EPA proposed standard, based on assumptions made in sections of the Clean Water Act, may not be able to be met in Virginia, which is a net precipitation state. (P-10(H1).3)

Response: The Clean Water Act standards apply to wet as well as dry climates, as do the final standards for uranium mill tailings issued under UMTRCA. We have no reason to believe they cannot be met in Virginia, but we recognize that experience with milling uranium in such locations is relatively limited. (Also see the response to Comment 11, A.1.1.)

Comment 13: Tailings pile discharge may be very difficult to prevent because of Virginia's elevated water table (vs. arid region's water table). (P-8(H1).5)

Response: The final standard allows necessary discharges, subject to concentration limits given in 40 CFR 440, Subpart C.

Comment 14: Does 40 CFR 192 apply to tailings disposal in non-arid regions? If not, how would a standard for non-arid regions differ from the proposed standard? (S-5.10)

Response: The standards apply to all licensed uranium processing facilities, whether located in arid or non-arid parts of the United States.

Comment 15: The proposed standards do not consider mining in non-arid regions. (F-1.7, I-19.1, I-27.1, S-5.10)

Response: Non-arid regions were considered in determining final standards.

Comment 16: EPA bases its standards on the assumption that mining and milling activities will continue to be restricted to arid, low population areas of the West, and fails to take into consideration the proposed uranium development in the Commonwealth of Virginia. (P-5(3).1, P-33.2, P-38.1, P-39.1, P-40.1, P-43.1, S-3(2).18, P-4(H1).15, P-5(H1).1, P-5(H1).3, P-10(H1).2, P-8(H1).1, I-15(6), S-5.10, I-19.1, F-1.7, P-5(H1).16, P-5(H1).10, I-15(2).5, P-65.1)

Response: EPA's analysis refers to practices and conditions that characterize the U.S. uranium milling industry, which generally does operate in arid and semi-arid regions of the West. For the most part, these characteristics affect our analyses of the technical and economic requirements for satisfying alternative standards. We are confident that the final standards provide adequate public health protection for all regions of the United States. In fact, the basic water protection requirements were developed for national application to hazardous waste sites. Until we analyze uranium mill operations in high precipitation climates, however, we will not be as knowledgable of the costs and techologies needed to satisfy these standards under such wet conditions as we are for mills operations in arid or semi-arid climates. Also see responses to Comments 11-15, A.1.1.

Comment 17: Virginia should not be sacrificed in order to find out the effects of tailings in a net precipitation area. (P-40.5)

Response: See the responses to Comments 11-16, A.1.1.

Comment 18: EPA should consider imposing a temporary moratorium on the construction of uranium mills in net precipitation zones until such disposal can be demonstrated to be safe or 10 CFR 192 is amended to specifically address this problem. (P-1(2).47)

Response: We don't believe such a moratorium is necessary. The disposal standards have adequate provisions for wet and dry areas. See the responses to Comments 11-16, A.1.1.

!*Adequacy of the DEIS*!

Comment 19: The DEIS is defective in that it does not designate and support a proposed Agency action. (P-4(H1).4, (P-2.5)

Response: The DEIS is primarily an analysis of alternative actions. The comment is inconsequential, however, because EPA published and distributed its proposals simultaneously with issuing the DEIS.

Comment 20: We concur with EPA's primary control objectives, but note that the DEIS does not provide sufficient data to evaluate the effectiveness of the alternatives. (P-9(3).6)

Response: The comment refers to certain judgments regarding the performance of covers in stabilizing piles and inhibiting misuse. The FEIS, Volume I provides such information as is available and useful in judging, on the one hand, the expected performance of a given cover design, and, on the other hand, the designs needed to satisfy stipulated performance criteria, such as effective longevity. Ultimately, however, site-specific factors may dominate engineering decisions of the particular designs needed to comply with a standard. Our analysis is sufficient for its purpose, i.e., to compare the costs and benefits of alternative degrees of control.

With regard to misuse, the issue is more judgmental. EPA believes that earthen covers of, say, less than 1 meter thickness, provide virtually no significant barrier to misuse, and that covers greater than 2 meters thick do provide a significant barrier. Again, such broad judgments are sufficient for analytical purposes.

Comment 21: Limiting the analysis to tailings generated by the year 2000 underestimates the health risks from uranium tailings. Projections to the year 2020 can be made with confidence now. (P-4(H1).9)

Response: We disagree with the statement that projections of tailings generation can be made to the year 2020 with confidence. Even if a reliable schedule of operative reactor capacity to this date were well known, which it isn't, there would still be a great deal of uncertainty in projecting the quantity of mill tailings generated throughout this period. To estimate the quantity of mill tailings, one has to know the uranium production at conventional mills, the ore grade and the uranium recovery rate. The ore grade and recovery rate varies significantly from mill to mill and also changes over time at a given mill. To project the uranium production at conventional mills, one has to postulate scenarios for the following: a schedule of utilities' uranium deliveries to DOE enrichment plants, the role of imports of both natural and enriched uranium, a schedule of inventory adjustments, production from nonconventional uranium sources, and capacity utilization rates at conventional mills. We believe that extending the industry projection beyond the year 2000 would extend these uncertainties to an unacceptable level. In any case, such an analysis would not affect our conclusions for the standards, which primarily depend on analysis of a generic pile.

!Data in the DEIS Are Incorrect or Out-of-Date!

Comment 22: Table 3-1 in EPA 520/1-82-022 has outdated or incorrect information concerning the Dawn Mining Company mill tailings in Ford, Washington. EPA lists Dawn Mining Company as an operating mill, when it is actually shut down. Also, Western Nuclear in Wellpinat, Washington, is anticipated to enter a shut-down mode within the next several months. (S-6.7, S-6.8)

Response: Information on all tailings piles and the operating status of all mills has been updated.

Comment 23: Table 3-1 on page 3.6 of the DEIS includes a figure of 7.8 kCi/y for estimated radon release from the Atlas Moab mill. This estimate appears to be unnecessarily high. (I-5(2).15)

Response: This estimate was made using the radium concentration in the tailings and the total area covered by the tailings. It was assumed the tailings are dry, which is appropriate for representing post-operational conditions. The footnotes (b), (c), and (d) apply to this estimate.

Comment 24: Table 3-1 on page 3.6 of the DEIS designates the impoundment as unlined. This designation is technically correct in that no engineered liner was installed. However, significant self-sealing may have occurred due to acidic effluent mixing with lime and alkaline leach to form gypsum. (I-5(2).16)

Response: No response is necessary.

Comment 25: Table 3-2 on page 3.8 of the DEIS indicates that the pH for Atlas' tailings pond liquids is neutral. Current readings show the pH to be 1.7, due to the fact that the alkaline-leach has been curtailed. (I-5(2).17)

Response: This value has been changed in Table 3-2.

Comment 26: Contrary to EPA's conclusion, no groundwater degradation has occurred beyond Western Nuclear's Split Rock Mill site boundary in the direction of defined groundwater users. However, EPA's arbitrary imposition of drinking water and nondegradation standards within the site boundary could require cessation of use of the current tailings pond. I-1(2).23

Response: This conclusion was reached by the Mineral Resources Waste Management Team of the College of Mines and Earth Resources, University of Idaho, in their report, "Overview of Groundwater Contamination Associated with Six Operating Uranium Mills in the United States," dated December 30, 1980, and referenced in the DEIS and in Volume 1 of the FEIS. EPA agrees that one of the options for corrective action for cleanup of contaminated groundwater is cessation of use of the current tailings pond and use of a new lined impoundment but other methods may also be considered. We don't agree that the standards are aribtrary; non-degradation is a reasonable basis for long-term health and environmental protection standards.

Comment 27: EPA implies that pump-back systems will be used to control groundwater contamination at Dawn Mining Company. Since the levels don't appear to present a health problem and appear to have stabilized, this engineering control measure is not necessary at this time. (S-6.9)

Response: Groundwater pump-back systems are options for corrective actions to cleanup contaminated groundwater. EPA does not imply that any particular option should be used at any particular site, since this is a regulatory decision.

!Data in the RIA Are Irrelevant, Out-of-Date, or Incorrect!

Comment 28: Comments regarding the Regulatory Impact Analysis for Active Sites (DRIA 83):

Comment 28-01: Re: Page 2-17, Table 2.10 - Table is out of date. (I-1(2).71)

Response: Data in this table have been updated to January 1983.

Comment 28-02: Re: Page 2-18, Table 2.11 - Table is out of date and has no relevance to the RIA. (I-1(2).72)

Response: EPA disagrees with the comment that the table has no relevance to the RIA. Concentration ratios are widely used and accepted measures of industry characteristics, the presentation of which is the purpose of the industry profile. The table shows the trend in concentration ratios for selected years from 1971 through 1982. We do not believe that this information is out of date.

Comment 28-03: Re: Page 2-19, paragraph 3 - Data used in this statement is out of date. EPA had more current data in Reference E but did not update its statement. (I-1(2).73)

Response: The data for 1982, from the most recent Department of Energy, Energy Information Administration (DOE/EIA) survey have been added to this paragraph. However, the point of the statement has not been changed by the updated estimates.

Comment 28-04: Re: Page 2-19, paragraph 4 - Data is out of date and incorrect. U.S. exports have declined substantially. The statement does not reflect the actual and current situation. (I-1(2).74)

Response: The data for 1982 have been added to this paragraph.

Comment 28-05: Re: Page 2-20, Table 2.12 - Data is out of date. (I-1(2).72)

Response: See the response to Comment 28-04.

Comment 28-06: Re: Page 2-21, Table 2.13 - Table has no relevance to RIA. It is incomplete. (I-1(2).74)

Response: The role of imports in supplying future uranium deliveries has been assessed according to DOE/EIA's latest estimates and has been incorporated into the new projections used in the RIA, as explained in Appendix B.

Comment 28-07: Re: Page 2-22, paragraph 3 - EPA's statement on uranium reserves is wrong. The EPA reference states "resources," not "reserves." The EPA reference is out of date. Further, EPA states Sweden has 17 percent of world reserves, whereas that nation does not list uranium reserves. Reserves are not resources, as EPA states. (I-1(2).77, I-1(2).114)

Response: This statement has been revised, and reflects information contained in a recent DOE/EIA report.

Comment 28-08: Re: Page 2-23, Table 2.14 - This table has no relevance to the RIA. (I-1(2).78)

Response: EPA disagrees with comment. Estimates of domestic uranium reserves are relevant to an analysis of domestic uranium production.

Comment 28-09: Re: Page 2-24, Section 2.2.4 - Employment data are out of date. (I-1(2).79)

Response: The data have been updated.

Comment 28-10: Re: Page 2-24, paragraph 5 - Data and projections for planned expenditures are out of date. (I-1(2).82)

Response: The data have been updated.

Comment 28-11: Re: Page 2-25, Table 2.15 - Data are out of date. (I-1(2).83)

Response: The data have been updated.

Comment 28-12: Re: Page 2-26, Table 2.15a - Data are out of date. (I-1(2).84)

Response: The data have been updated.

Comment 28-13: Re: Page 2-1, Paragraph 3 - DOE81b is outdated. It is a 1981 report which used 1979 data. (I-1(2).50)

Response: The statement has been deleted from the RIA.

Comment 28-14: Re: Page 2-2, Paragraph 6 - Data are out of date. Eighty-six reactors have been cancelled since 1975, not 50. (I-1(2).52)

Response: The data have been updated.

Comment 28-15: Re: Page 2-5, Table 2.2 - Data are out of date. (I-1(2).53)

Response: The data have been updated.

Comment 28-16: Re: Page 2-6, Paragraph 1 - Data are out of date. Projections of U.S. uranium demand for nuclear fuel through the year 2000 are again being revised downward. (I-1(2).54)

Response: The statement has been revised.

Comment 28-17: Re: Page 2-6, Paragraph 2 - Data used in Appendix B, Projections of Price, Demand, and Production are out of date. (I-1(2).55)

Response: A new projection of uranium industry activities based on the most recent projections made by DOE/EIA was used in the RIA and is described in Appendix B.

Comment 28-18: Re: Page 2-6, Paragraph 4 - Data in Reference Ta79 are incorrect. (I-1(2).56)

Response: The statement has been revised to reflect the most recent DOE/EIA estimates.

Comment 28-19: Re: Page 2-7, Table 2.3 - Statistics are out of date. (I-1(2).57)

Response: See the response to Comment 28-17, A.1.1.

Comment 28-20: Re: Page 2-8, Paragraph 1 - The statement, "... about 80 percent of anticipated uranium deliveries from 1981 to 1990 will be purchased under either contract or market price contracts" has no relevance to the purpose and objective of the RIA. (I-1(2).58)

Response: EPA disagrees with the comment. We feel that information on the type of procurement mechanisms used in the uranium industry is relevant for presenting an economic profile of that industry. The quantities of uranium upon which these percentages are based has been included in the table.

Comment 28-21: Re: Page 2-9, Table 2-4 - This table is not relevant to this study, as EPA does not indicate how much uranium is involved versus total demand. (I-1(2).62)

Response: See the response to Comment 28-20, A.1.1.

Comment 28-22: Re: Page 2-10, Table 2-5 - Not relevant to this study, as EPA does not say how much uranium is involved in contracts versus total demand. (I-1(2).63)

Response: The quanities of uranium underlying the reported contract prices are unpublished, but we have obtained the information from DOE/EIA and included it in the relevant tables.

Comment 28-23: Re: Page 2-11, Table 2-6 - Not relevant to this study, as EPA does not say how much uranium is involved in contracts versus total demand. (I-1(2).64)

Response: See the response to Comment 28-22.

Comment 28-24: Re: Page 2-13, paragraph 3 - The paragraph leads a person to believe that the uranium mining and milling industry was expanding up to 1981 whereas the industry slumped in the first six months of 1980. Furthermore, it was not the surplus of uranium from domestic sources forcing a curtailment of operations. It was the impact of foreign imports from Canada, Australia, and South Africa operating under government subsidy, lower wages, and less regulatory control. (I-1(2).65)

Response: EPA disagrees with the comment. Inventory surplus was created before significant import penetration was established.

Comment 28-25: Re: Page 2-13, paragraph 3 - In the same paragraph, EPA says 8 mills closed during 1981 and 1982. The data are out of date. (I-1(2).66)

Response: The data on the operating status of mills has been updated from September 1982 to January 1983.

Comment 28-26: Re: Page 2-13, paragraph 5 - Data are out of date. (I-1(2).67)

Response: The data have been updated.

Comment 28-27: Re: Page 2-16, paragraph 3 - Statement is not relevant to the RIA. (I-1(2).69)

Response: EPA disagrees. Identification of the companies that own uranium milling operations is relevant to an analysis of the milling industry.

Comment 28-28: Re: Page 2-16, paragraph 4 - Statement is out of date and not relevant to RIA. (I-1(2).70)

Response: See the response to Comment 28-02.

Comment 28-29: EPA's use of out-dated industry data makes its regulatory analysis of the impact on industry totally unrealistic. EPA's conclusion that one mill will close as a result of its proposed standard totally ignores the depressed state of the industry. EPA must consider market conditions in its analysis. (I-4(3).111, I-4(3).114)

Response: All historical data in the RIA have been updated to include the most recently published information available. Additionally, a new set of uranium activity projections, based on the most recent DOE/EIA projections, was used in the analysis. Also, a different methodology of projecting impacts of tailings disposal costs on aggregate industry capacity and production was used which we believe incorporates the effect of more realistic market conditions. The comment is erroneous, however, when it states that "under the EPA methodology, the worse the market and industry conditions, the smaller might be the additional adverse impact of imposing EPA's proposed standards (since EPA counts only closures that are not attributable to market conditions)". EPA makes separate estimates of both market closures and control-caused closures. The control-caused closures are estimated independently of the market closures. However, market conditions are reflected in the cash-flow analysis by way of the DOE/EIA price projection.

Comment 28-30: Re: Page 2-1, Paragraph 2 - The industry has experienced rapid growth as a result of promotion by the AEC, not because of expectations of rapid increases in demand. This forced utilities to prematurely enter the market place. (I-1(2).48)

Response: EPA does not disagree with the comment, but feels that it is not necessary to determine if it was the Federal Government or utilities that created the expectation of increases in uranium demand.

Comment 28-31: Re: Page 2-1, Paragraph 2 - A better description of the uranium marketplace is that inventories continue to grow, production has fallen, demands continues downward, and foreign imports are increasing. (I-1(2).49)

Response: The statement has been revised.

Comment 28-32: Re: Page 2-2, Paragraph 5 - Contrary to EPA's belief, higher fuel costs did not have an impact on the slowdown of nuclear plant construction. (I-1(2).51)

Response: The statement refers to the (slower) growth in demand for electricity, not nuclear plant construction. EPA has re-examined the statement and decided that it is correct.

Comment 28-33: EPA errs in stating that a richer deposit "permits lower pricing." Richer deposits, in fact, permit higher profits, or allow marginal operations to continue operating. (I-15.7)

Response: EPA agrees that the statement should be revised. However, we have not been able to find the statement within the voluminous documentation that was prepared in support of the standards. The commenter's letter did not indicate where the statement was contained and an inquiry to the commenter has been unanswered as of this time. Therefore, we have been unable to make the revision.

Comment 28-34: Re: Page 2-22, paragraph 2 - The statement that "the use of foreign uranium, though economic, appears to be limited for other reasons" is without foundation. We would like to see EPA develop more factual evidence of "Buy American." As a producer, we have not experienced the "Buy American" phenomenon stated by EPA. (I-1(2).74, I-1(2).75)

Response: Whether or not there is factual evidence to support the "Buy American" phenomenon is not an issue in the RIA. The RIA merely cites a variety of public statements by prominent people in the uranium business to establish that there is uncertainty in predicting the future penetration of imports in supplying U.S. utilities' uranium demand.

Comment 28-35: Re: Page 2-22, paragraph 2 - EPA could have used available data to develop projections of foreign imports instead of facing the issue head-on. I-1(2).76

Response: See the response to Comment 28-06.

A.1.2 Form of the Standards

!The Standards Should Consider Site-Specific Factors!

Comment 1: The standards should be more flexible and realistic so that site-specific factors can be taken into account. (I-20.7, I-10(2).3)

Response: The analysis we presented in the RIA and EIS extensively considered a realistic range of circumstances, in part to assure that our general standards would be practical to apply site-specifically. Indeed, except to the extent required by law, our standards do not specify the methods by which they may be satisified, and site-specific factors clearly may be taken into account in the choice of such methods.

Comment 2: The Agency should consider site-specific recommendations in preference to a general standard. (P-9(H1).6)

Response: Public Law 95-604 (UMTRCA78) requires EPA to "...promulgate standards of general application...". The legislative history indicates very clearly that Congress did not intend EPA to establish site-specific requirements.

Comment 3: EPA should develop standards stressing stablization and isolation and considering site-specific factors to prevent misuse and erosion. Since such regulations would be unrelated to radiation exposures, they should not be expressed in terms of release or dose limits. (P-9(3).8)

Response: We don't believe EPA could issue such standards under our authority. Furthermore, we believe a radon emission limit is needed for adequate public health protection.

!The Standards Should Be General!

Comment 4: We recommend the adoption of general standards governing radon release, groundwater protection and long-term stability, applicable to all sites. (P-45.5)

Response: EPA agrees, and is issuing such standards.

!Standards Should be in Terms of Emission or Emanation Rates!

Comment 5: A radon emanation standard is preferable to a fencepost concentration standard because radon emanations are easily measured and provide a confirmed value for exposure pathway analysis.By contrast, a fencepost concentration standard does not provide the same positive control and would make implementation and verification impossible. (P-4(H1).13, P-26.9)

Response: The comment refers to the post-closure standard. EPA agrees. EPA also prefers an emission standard; however, see the responses to Comments 6 and 8, A.1.2.

Comment 6: A radon flux standard for disposal is preferable to a health-based standard since radon measurements will have to be made to verify the thickness and appropriateness of cover materials. (P-1(2).29)

Response: EPA also prefers a flux standard, but we believe covers can adequately be designed using measurements of the tailings and cover materials, without measuring flux. See the response to Comment 8, A.1.2.

Comment 7: The Clean Air Act requires that standards be expressed as emission standards subject to monitoring. Thus, design standards are necessary but not sufficient. (P-45.14, P-45.9)

Response: We don't believe a requirement to measure emissions for 1000 years is practical. This disposal standard must necessarily be a design standard. See the response to Comment 1, A.6.2.

!Standards Should Not Be in Terms of Emission or Emanation Rates!

Comment 8: Radon flux measurements are imprecise and give results of such variability as to invalidate this technique as a basis of measurement. (I-22.7)

Response: Flux measurements are highly variable, but averages over time and area are nevertheless meaningful. However, our standard does not require flux measurements. See the responses to Comment 6 and 7, A.1.2.

Comment 9: Measuring the average flux from the soil surface is difficult because of the huge temporal variations in flux values that are known to occur. (I-16(2).4, I-29.4)

Response: See the responses to Comments 6, 7, and 8, A.1.2.

!Standards Should Be in Terms of Concentrations!

Comment 10: A radon concentration (performance) standard is preferable to an emanation standard as it relates directly to public health and risk, and can be used to evaluate the effectiveness of the remedial action. Radon emanations are difficult to measure and cannot be directly related to risk and safety. (P-9(H1).9, S-13(H2).3, I-4(3).36, I-5(2).5, F-5(3).4, I-30.2, I-29.3)

Response: EPA disagrees. Based on current scientific evidence, we believe it prudent to establish standards for radon on the assumption that any level may be harmful, and that the likelihood of harm increases with the exposure. Therefore, exposures should be kept as low as is reasonably achievable. Considering that radon released from tailings may be transported long distances, the best way to limit overall population exposure is by limiting releases. Our emission standard applies to the design of the disposal system, and does not require measurements of radon emanation.

Comment 11: We recommend that, rather than a radon emanation standard, EPA adopt a radon daughter concentration limit (expressed in Working Levels) at the site boundary. (I-4(3).35, I-4(3).40, I-23.4)

Response: A radon concentration (or working level) standard at the site boundary must be enforced by institutional methods, i.e., by limiting people's access to and use of the area within the boundary where the standard may be exceeded. For long term control, EPA believes reliance on physical controls is preferable. Furthermore, as noted above, a concentration standard at the site boundary would not necessarily limit radon emissions. We find that limiting emissions for a long time is practical, and that the benefits justify the costs.

Comment 12: We support the approach recommended by national and scientific organizations, and adopted by the NRC, in which acceptable concentration limits for specific isotopes in water are established for restricted and unrestricted areas. (I-11(2).11)

Response: The comment refers to maximum concentration limits established for application without regard to the nature of the specific radioactivity source. These organizations also require specific sources to maintain radiation exposures at levels that are as low as reasonably achievable. EPA's standards, in effect, represent the lowest reasonably achievable generally applicable levels for uranium mill tailings. These standards, therefore, are consistent with the approach of these organizations.

Comment 13: We suggest that it might be better to establish an absolute radon concentration limit around a tailings pile instead of a concentration above background, since in many areas the background values are not well known and also the absolute value more nearly reflects the true public health hazard. (I-16(2).5, I-29.5)

Response: Were EPA to establish a radon concentration standard, this would be an important practical consideration. For reasons described above, however, we have chosen an emission standard.

Comment 14: EPA should adopt a radon concentration standard to allow flexibility in the means of achieving compliance. (I-4(3).37)

Response: A concentration standard applied at an arbitrary and movable location, such as the "site boundary," would not be adequate because it could be satisfied by dispersion. EPA finds it practical and justifiable to reduce radon emissions, so as to reduce the overall long term effects of such emissions on populations.

!The Standards Should Be in Terms of Emission Rates or Maximum Concentrations!

Comment 15: We strongly support the use of emission rate or concentration standards in preference to dose rate standards. The uncertainties involved in analysis of dose rates make them unworkable. Further, changing land use around a facility could result in noncompliance with dose rate standards even though the facility met the standards when it was designed. (P-22(H2).1)

Response: EPA agrees, at least with respect to our preference for an emission standard.

Comment 16: If EPA adopts a radon flux standard it should provide all licensees the option of complying with an alternative equivalent radon concentration standard. (I-10(2).10, F-5(3).4)

Response: We do not believe an equivalent concentration standard would be useful, because determining equiivalence implies relating the concentration to the emission rate by using meteorological transport calculations. An emission standard is simpler and more direct. Also see the response to Comment 11, A.2.0.

A.1.3 Definitions

Comment 1: It is possible to construe Section 192.32(a)(2)(i) as requiring uranium and molybdenum to be considered hazardous constituents only during processing and not afterwards. They should be treated as hazardous constituents at all times. (S-5.5)

Response: The final rule makes it clear that uranium and molybdenum are added to the list of hazardous substances "for the purposes of this subpart," with no other restrictions indicated.

Comment 2: EPA should define exactly which stockpiles at mills are covered by the proposed standard. (S-3(H2).2)

Response: This is defined by UMTRCA itself. The covered materials are those defined as byproduct materials under Section 11e of the Atomic Energy Act, as amended by UMTRCA.

Comment 3: EPA incorrectly defines the Working Level Month (WLM) as a physiologically weighted exposure. The WLM is simply a time integrated exposure unit. (P-9(3).12)

Response: EPA agrees in part. The working level month is a time integrated exposure unit for underground miners. Rather then introducing a new unit for time integrated population exposure, EPA staff chose to weight the occupational exposure unit to take account of differences in the breathing patterns of working uranium miners vis a vis a residential population of both sexes (EPA 79a). We believed that this was compatible with Dr. Robley Evans' injunction (Ev79) "to describe radiation exposure, the Working Level unit of short-lived radon decay product concentration should be multipled by an average breathing rate in l/min, by an average fractional retention in the lung, and by the duration of exposure". Nevertheless, it might have been more defensible in a purely technical sense to express the daughter product concentration as potential alpha energy per unit volume of air, in units of joules per cubic meter. We note, however, that such a unit would be meaningless to almost all readers of the EIS and would inhibit relating risk data for uranium miners for any given time-integrated exposure to the risk for the general population from a similar level of exposure.

Comment 4: Arid regions should be defined. (F-1.7)

Response: We have used the term "arid regions" loosely to characterize the areas in the western S.S. where most uranium production occurs and where the average evapotranpiration rate exceeds the precipitation rate. The final rule clearly distinguishes "arid" and "wet" regions where such a distinction is needed (see Section 192.32(a)(1)).

Comment 5: EPA's concepts of costs and benefits should be more precisely defined and quantified. (P-9(3).1, P-9(3).2)

Response: We believe our usage is clear in the context of the documents supporting the standards. To restate: costs include such items as the dollar cost of obtaining, installing, and maintaining controls, and accidental or radiation-induced deaths to workers involved in carrying out these activities. Quantified and unquanitified benefits include such items as radiation deaths avoided, environmental degradation avoided, and environmental contamination removed.

A.1.4 Responsibilities of the EPA and the NRC

Comment 1: We wish to offer a clarification to NRC's interpretation of the recent amendments to the Atomic Energy Act, enacted in the NRC Authorization Act of 1982 (P.L. 97-415; see NRC letter; Docket A-82-26, IV-D-137), as it relates to EPA's role in setting the level of protection from tailings. The intent of these amendments is to give Agreement States and licensees authority to propose alternative means of reaching a certain level of protection, but the level of protection is to be set by the NRC and EPA. Furthermore, the NRC and EPA are not required to adjust the level of protection to the alternatives proposed by licensees. (F-4(2).1)

Response: EPA understands that EPA is required to set generally applicable standards, and that NRC and Agreement States are to establish regulations that implement EPA's standards.

Comment 2: EPA's proposal to issue "facility permits" is a duplication of the NRC's authority to license under UMTRCA. (I-28.2, I-28.9)

Response: EPA did not propose to issue facility permits, and is expressly forbidden from doing so by UMTRCA. Also see response to Comment 25, A.1.4.

!The Standards Meet EPA's Responsibilities!

Comment 3: The proposed standard provides adequate measures to control radiological hazards during operations and disposal. The measures for control and stabilization of tailings assure adequate protection of public health, safety, and the environment. (F-2.1, S-6.1)

Response: EPA agrees. The final standards differ in detail from the proposals, but they provide the same basic level of protection.

!The EPA Has a Responsibility to Upgrade the Standards to Protect the Public!

Comment 4: Under UMTRCA and the CAA, EPA is directed to set standards which will protect public health. It was not authorized to decide how. Neither Act limits the degree of health protection to the level which EPA thinks is affordable or "cost effective." EPA is without statutory authority to decide that our society will not pay the cost of protecting victims of preventable radiation pollution. (P-45.12)

Response: UMTRCA, as amended, is very clear in requiring EPA to consider all relevant factors, including cost and health risk. The Clean Air Act requires standards that in EPA's judgement provide an ample margin of safety. Congress did not describe the degree of protection that provides an ample margin of safety, nor did it describe what factors EPA should consider in making judgements on the appropriate standard.

Comment 5: Given the potential hazards associated with tailings, it is reckless of EPA to propose these weakened standards. It is mandatory to impose strict standards to protect groundwater. Promulgation of disposal standards should be deferred unless they require complete (3 meter), long term (1000 year) surface cover for the tailings. (P-31.2)

Response: The groundwater protection standards are quite protective. The primary groundwater protection standard is for new impoundments to be designed to be capable of isolating wastes from the ground. The secondary standard protects groundwater at new or existing impoundments from degradation by any hazardous constituents that may reach an aquifier. The disposal standard requires reasonable assurance of control for up to 1000 years; the cover will be designed site-specifically to reduce radon emissions to 20 pCi/m^2-sec. We estimate that such covers generally will need to be at least 2-3 meters thick.

Comment 6: The proposed standards allow too great a cancer risk for residents in uranium processing areas such as our own, specifically, the 1 per 500 allowable deaths. These residents have just as much right to protection from the potential threats of radiation as do citizens protected under other standards where the allowable risks in the range of one death in 100,000 to 1 in one million are customary. (P-35.3)

Response: Based on an improved analysis, we have revised our estimate of the maximum risk for people who live very near tailings piles, downward to less than 1 in 1000. As we describe more fully in the Preamble, we have concluded that it is not reasonable to reduce the emission standard for disposal of tailings piles because of (1) the uncertainty associated with the feasiblity of implementing undemonstrated technology to satisfy a requirement for a significantly lower standard, (2) the small increase in total health benefits associated with a lower standard, and (3) the limited circumstances in which the maximum theoretical risk to individuals might be sustained.

Comment 7: EPA's proposed standards are less protective of the public than those previously enforced by the NRC. Rather than a 95% reduction in risk, EPA's standards result in a tenfold increase over the 2 pCi NRC standard. This is not justified by the EPA. (P-5(3).3, P-5(3).4, P-5(H1).5, P-5(H1).10, P-8(H1).13)

Response: EPA's standard does indeed amount to a 95 percent risk reduction. Except for a brief period, Congress has forbidden NRC from enforcing its regulations ever since they were issued in October 1980. Furthermore, NRC's comments on EPA's proposal recommended against applying an emission control requirement. Detailed radon emission analysis justifying EPA's standard is given in the EIS, RIA, and the Preamble for the final standards.

Comment 8: Why are cleanup standards being weakened, groundwater not being protected and the allowable level of radon gas emissions being raised tenfold? (P-6.2, P-5(H1).11, P-8(H1).13, P-8(H1).16)

Response: See the responses to Comments 5 and 7, A.1.4.

Comment 9: The proposed standards must be thoroughly upgraded. NRC's standards are more appropriate. (P-6(2).4, P-44.1)

Response: See the response to Comment 7, A.1.4.

Comment 10: The standards should be more stringent. Alternative F in the DEIS comes closest to meeting our concerns for longevity, radon emanations, and groundwater protection. Such an alternative is feasible, and its costs are insignificant compared with the price of U_3O_8 and the unknown impacts of future generations. (P-35.8)

Response: EPA believes the benefits gained by requiring control at the levels of Alternative F rather than Alternative D are small compared to the incremental costs and the questionable technical feasibility of achieving the standard. (The designations "F" and "D" used here refer the Preamble and DEIS for the proposed standard.) The alternatives were reformulated for analyzing a final standard. Our reasons for selecting the final standards are fully described in the Preamble to the final standards.

Comment 11: I urge the adoption of the most stringent of the proposed standards designated as "Alternative F": in your Draft Environmental Impact Statement. (P-12.1)

Response: See the response to Comment 10, A.1.4.

Comment 12: EPA's proposed standards are inexcusably and unacceptably lax and contrary to EPA's statutory responsibility to protect the public health and safety. (P-33.14, P-5(H1).6, P-5(H1).2, P-5(H1).8, P-8(H1).15, P-8(H1).16, P-36.1)

Response: EPA disagrees. Detailed justifications for the standards are given in the EIS, RIA, and the Preamble.

Comment 13: The EPA should err in the direction of being overcautious rather than too lenient. (P-12.2)

Response: EPA recognizes that its primary responsibility is to protect health and the environment. We base our actions on the best scientific information we can obtain, with prudent allowance for uncertainties.

Comment 14: Is the Agency intervening to protect the public only at the convenience of industry? (P-8(H1).9, P-8(H1).19)

Response: Clearly not. EPA analyzes technological and economic effects of the standards mainly to assure they are practical and to comply with legislative or policy directives. We determine the need for standards, however, primarily by analysis of health risks.

Comment 15: We must be responsible to future generations in our effort to regulate mill tailings. (P-60.1)

Response: EPA agrees.

!EPA's Responsibilities Do Not Require Such Stringent Standards!

Comment 16: In the past, the methodology of nuclear regulators in an uncertain situation has very often been to compensate by making conservative assumptions, producing conclusions and overdesigns in which errors on the side of conservatism are multiplied manyfold. In the case of the present standards, we believe that EPA need not and should not be so conservative, for several reasons: (1) the health risk consequences of being wrong are relatively inconsequential, and can be remedied when and if indications of problems arise; (2) the spectrum of remedial technical options available at a later time may be larger and more attractive than those now known; (3) experience may reveal institutional controls more reliable than EPA now credits; and (4) there is little room for unnecessary excess caution because much of the industry is now economically vulnerable to permanent closure. (I-10(2).2)

Response: EPA believes that Comments 1, 2, and 3 are inconsistent with the legislative history and language of UMTRCA, which indicate that Congress intended long term control of tailings to be applied now. EPA has not found reasons to defer action. Specifically, (1) we find the health risk sufficiently well established to justify the standards we are issuing; (2) we believe available technical options are sufficient for our current purposes; and (3) we believe institutional methods are not capable of controlling radon emissions, nor of preventing releases of harmful substances to groundwater, which are two major goals of the standards. Furthermore, further experience may or may not show institutional controls to be reliable. With respect to Item 4, EPA has analyzed the impact of the standards on the industry and finds it marginal (see the RIA for details). We estimate that for the most probable case, where market conditions force mills to absorb the entire cost of the standards, only one small (model) mill may close because of the standards.

Comment 17: The standards being required by the proposed regulations are excessive and not necessary to protect the health of nearby residents and the environment. For example, New Mexico has in place groundwater and radiation standards that adequately fill this need. (I-9(2).5)

Response: The EIS and RIA present extensive analyses indicating that the cost of the standards is justified by the benefits. Radon emission controls are shown to be necessary to avoid excessive risks for nearby residents and cost effective in reducing the cumulative lung cancer risk for the general population. The adequacy of groundwater standards is a matter of judgement. Congress directed EPA to issue standards for nonradiological hazards (which primarily occur through waterborne pathways) that are consistent with standards the Agency has adopted for hazardous constituents from other waste disposal sites.

Comment 18: The proposed standards are overly restrictive, unnecessary to protect public health, unreasonable on the basis of costs and benefits, and will inhibit continued operation at most sites. EPA should substantially revise the proposed standards for uranium tailings. (I-11(2).1, I-6(3).86)

Response: The EIS, RIA, and Preamble provide extensive analyses that refute these comments. In particular, the economic impact analysis shows that the standards will most likely not lead to any mill closures.

Comment 19: The proposed standards are excessively stringent, insufficently supported by scientific data, and will result in unjustified costs to industry. In some cases compliance is impossible, and in other cases meaningful measurements cannot be made to verify compliance. (I-22.5)

Response: EPA disagrees. The commenter's specific criticisms are answered elsewhere in this document under appropriate headings.

Comment 20: It is ironic that the Federal Government is regulating this trivial source of radon exposure, while at the same time is encouraging citizens to seal up their houses as a conservation technique, thus exposing people to the principal radon hazard. The principal reason for society's fixation on radon from uranium is that uranium is used to generate nuclear power. (I-6(H2).26, I-6(4).7, I-6(H2).22)

Response: EPA believes radon from tailings is a significant radiation source, but recognizes that nature as a whole constitutes a far larger source. The remainder of the comment does not require a response, as it does not relate to this congressionally-mandated rulemaking for controlling tailings piles.

Comment 21: EPA owes a duty to workers not to impose requirements which unnecessarily make their companies uncompetitive and which throw them out of work. (P-48.2)

Response: See the last part of the response to Comment 16, A.1.4.

!EPA Has Exceeded its Authority by Proposing On-site Engineering Design Standards!

Comment 22: Many of EPA's proposed standards, such as the liner standard, and its specification of the compliance point and compliance period for groundwater protection, are implementing regulations which are beyond EPA authority to impose. EPA should leave implementation requirements to the NRC and the agreement state. (I-10(2).22, I-7(2).10, I-10(2).14, I-10(2).1, I-4(3).7, I-4(3).101, I-4(3).102, I-4(3).100, I-19.2)

Response: UMTRCA requires EPA to establish standards for hazards of nonradiological substances from tailings that are consistent with EPA's standards for similar hazardous constituents established under the Solid Waste Disposal Act, as amended. The liner standard and compliance point for groundwater protection are key elements of the existing SWDA standards. EPA has left implementation requirements to the NRC and Agreement States, as UMTRCA requires.

Comment 23: EPA should propose performance standards for groundwater protection and avoid specifying that synthetic liners be used. Natural liners can equal or surpass synthetic liners in groundwater protection. The regulatory agency should specify liner materials, based on site-specific characteristics. (I-23.1, I-28.1, I-6(4).14, I-13(2).2)

Response: The standards do not specify synthetic liners. However, as noted immediately above, EPA's standards for uranium mill tailings must be consistent with standards the Agency established for hazardous waste under the SWDA, as amended. These latter regulations require a liner that is capable of preventing the migration of wastes into the ground. Natural liners normally would not satisfy such a criterion. Natural liners or no liner may be used, however, where certain water protection criteria are satisfied. Our rulemaking record for tailings does not establish that either synthetic or natural liners have unequivocal advantages or disadvantages. We have concluded that commenters did not establish that conditions at tailings impoundments are sufficiently different from conditions EPA considered in developing the SWDA standard as to justify departures from that standard.

Comment 24: EPA's liner requirement is unlawful. EPA only has the authority to set off-site concentration limits, not to specify design and engineering requirements to meet such a limit. (I-6(3).49, I-7(2).10)

Response: EPA's authority is not limited to setting off-site standards. The allocation of responsibilities between it and NRC is functional, not geographic. See the response to Comment 22, A.1.4.

Comment 25: EPA's proposed 40 CFR 192.32(a)(2)(iv), which vests EPA with the authority to exempt hazardous constituents and to set alternative concentration limits, interjects EPA into site-specific licensing decisions. This is both unnecessary, inefficient, and contrary to the intent of Congress. (I-5(2).8, I-6(3).50, I-10(2).21, I-10(2).24, I-6(3).9, I-6(H2).33, I-6(H2).16, I-10(2).20, I-19.2, I-19.8, I-22.16, S-3(H2).8, F-6(2).3, F-5(3).7)

Response: Exempting hazardous constituents and setting alternative standards are standard setting functions, which EPA is authorized to perform. In the interest of administrative efficiency, EPA has revised the standard so as to minimize the need for the regulatory agencies to seek EPA's concurrence with site-specific exemptions and alternatives.

Comment 26: EPA's suggestion that there are a number of SWDA regulations that NRC must address is unclear. If EPA's meaning is that NRC must adopt additional regulations developed for hazardous wastes, the suggestion is unsupported, unlawful, and arbitrary. (I-6(3).71)

Response: EPA has not yet determined whether existing NRC regulations satisfy the requirements of UMTRCA as they relate to comparability with requirements EPA established for hazardous wastes under the SWDA. EPA has merely noted that NRC (and EPA) will have to address such issues once the final standards are promulated. We have also noted a need for NRC, as an implementer of EPA's standards, to establish necessary implementation rules and procedures.

Comment 27: The EPA standard for tailings covers should state that the tailings are to be protected against wind and water erosion for the specified time period, and should leave it to the implementing agency to determine how that standard should be achieved at the licensee's specific site. (I-10(2).8)

Response: Under EPA's standard, the implementing agency does have the responsibility and discretion to decide site-specific methods of compliance. We have found it necessary, however, to specify a radon emission limit in addition to a standard for erosion control.

Comment 28: EPA's rationale for the 20 pCi/m^2-sec standard makes it clear that it is not an environmental standard. It is an engineering design standard to require a 3-meter cover on tailings. EPA has exceeded its statutory authority. Such an on-site design limit can only be imposed by a licensing agency. (I-6(3).16, I-4(3).38, I-4(3).39, I-24.2, I-4(3).39)

Response: The statutory distinction between EPA's and NRC's jurisdiction is between standard-setting and implementing functions, not between off-site and on-site boundaries. The radon emission design limit supports several EPA objectives for disposal of tailings piles, including the reduction of radon emissions to avoid lung cancers such emissions may otherwise cause. We anticipate that such earthen covers will often be applied to satisfy the standard, which is consistent with our goals of inhibiting misuses of tailings, protecting tailings against spreading by wind and water erosion, protecting water, and eliminating any significant gamma radiation exposures. The standard does not require any specific cover design. We believe we are authorized to set a limit on the emission rate for radon from tailings sites.

!EPA is Required to Submit Proposed Standards for Scientific Advisory Board (SAB) Review!

Comment 29: The proposed standards, by EPA's own definition, require submission to the SAB as a "significant regulatory action." EPA's failure to submit the proposed regulations to the SAB before publication is an egregious and fatal error. A possible remedy for EPA's action is to recall the regulations, submit a new set of proposed regulations to the SAB, and then, after review of the SAB's comments, publish a new set of proposed regulations. (I-5(2).2, I-5(2).1)

Response: This rulemaking has been listed on EPA's regulatory agenda for at least the last three years. The SAB from time to time reviews the agenda and selects rules for review. The SAB had the opportunity to review this rule, but did not choose to do so.

A.2.0 RISK ASSESSMENT

!EPA's Model Mill-Site Is Unrealistic!

Comment 1: EPA's framework for developing the standards employs a "model mill-site" which has only limited similarity to actual mill-sites. (I-10.1)

Response: We believe the model adequately represents the average characteristics of mill sites for the purpose of establishing these standards.

Comment 2: EPA should have used real-world, field data in its risk assessment. (S-6.3)

Response: Epidemiological data were considered in arriving at EPA's risk estimate for exposure to radon daughters and other forms of radiation.

Comment 3: Canonsburg, Pa., data are not included in the lung cancer table of incidence. We question any study which does not address the specific characteristics of the Canonsburg site. (P-65.2)

Response: The text of the DEIS contained risk estimates for the Canonsburg, Pa. site. The data in the table referred to were developed for an earlier report that did not consider this site.

!The Assumptions Used by EPA Are Too Conservative!

Comment 4: EPA has developed an excessively conservative set of standards because of overly conservative assumptions. (I-15.9)

Response: EPA disagrees. Health risk estimates are based on reasonable interpretations of available radiobiology data and on reports by primary investigators dealing with the raw epidemiology data. Metabolism and dosimetry estimates are state-of-the-art, and are not known to be conservative. Dispersion and pathway models are generally accepted methodology, with parameters chosen to reasonably estimate environmental concentrations. A conscious effort was made to avoid combining assumptions in such a way as to provide inappropriately conservative estimates.

Comment 5: There is little evidence that EPA considered testimony at Congressional hearings in setting its standards. The testimony provided ample evidence that radon risks from tailings are relatively low and that health effects are minimal unless tailings are misused. The standards should be directed towards preventing human health effects, should be stated in terms of dose limits, and should allow implementing agencies flexibility in meeting the standard. (F-5(3).2)

Response: The comment is in error. The hearings developed no evidence regarding radon risks. A number of individuals presented their views regarding radon risk. To the extent that these views were based on published studies, they were considered by EPA.

!EPA's Assessment of Health Decrements Is Not Inclusive Enough!

Comment 6: EPA has failed to consider non-fatal cancers, non-malignant diseases, and cumulative risks of ingestion, inhalation, and external exposure from a combination of radioactive elements. (P-1(2).21, P-15(H2).3, P-35.7)

Response: EPA disagrees. Cumulative risk of ingestion, inhalation, and external exposure are included in the DEIS Tables 6-1 to 6-6. Mention is made of non-fatal cancers, DEIS, reference Su81(1), but the issue was not discussed explicitly in the DEIS. The DEIS shows that the risks from tailings are dominated by lung cancer due to radon by about two orders of magnitude. Survivorship for lung cancer is negligible; hence, for the dominant risk there are no non-fatal cancers. Even for inhalation or ingestion of particulates most of the highly affected organs -- e.g., lung, red marrow -- are not noted for survivorship if cancer develops. Non-fatal cancers would be a relatively inconsequential addition to the total risk.

Comment 7: EPA's data sets and risk models are out of date and inappropriate. They understate health effects since they do not consider cancers other than lung cancer, non-fatal cancers, childhood diseases, adverse genetic outcomes, or other somatic effects linked to radiation exposures. (P-41.1, P-45.19, P-33.4)

Response: Risk estimates were made for cancers other then lung cancer; see Tables 6-1 thru 6-4, and Appendix C (FEIS I, Volume I). Compared to lung cancer, they represented an incremental risk of less then 1%. The estimated number of excess non-fatal cancers would be about the same as fatal ones, again about 1% or less of the estimated excess in lung cancer fatalities. The combined risk for fatal cancer other than lung cancer and for all non-fatal cancers is very much smaller than the uncertainty in the estimated risk of lung cancer. Parameters for calculating the genetic risk were given in Appendix C. We have used these data to calculate genetic impact and incorporated this information into the final EIS. Again, the estimated risk is much less than the uncertainty in the only major health effect, lung cancer due to radon exposure. We do not know of any childhood diseases associated with radiation exposure that have been omitted; at the dose rates of interest, no developmental effects are anticipated.

Comment 8: EPA cost benefit analysis considers only fatal lung cancers, and neglects other health issues, such as genetic effects. (P-1(H2-2).3, P-1(2).20, P-26.2)

Response: The DEIS discusses other health effects and points out that they are not significant in comparison to lung cancer. For this reason it is not meaningful to include them in the consideration of benefits and costs.

Comment 9: The greater sensitivity of the embryo, the fetus, and the young child to damage caused by radiation should be taken into account in setting these standards. (P-12.3, P-45.17)

Response: The risk estimates made in the DEIS are based on lifetime exposure and include risks incurred before adulthood. For the particular case of exposure to radon decay products, by far the most important health risk (see below), we made appropriate allowance for the smaller organ size and the decreased minute volume of children. The net effect of these changes is to increase exposure during childhood. However, we did not presume children had an increased risk per unit exposure, i.e., per working level month, because, as yet, there is no direct evidence for increased lung cancer sensitivity from radiation exposure during childhood. Nevertheless, there is evidence of increased sensitivity to radiation for the totality of all cancer risks. Therefore, in 1978, we examined how this might increase the lifetime risk (EPA79a). We calculated that if children were three times more sensitive than adults, it would increase their lifetime risk by about a factor of 1.5. Although this increase is less than the uncertainty in our risk estimates for lung cancer, we agree it may turn out that our risk estimates are somewhat low. For other cancers we used a lifetable analysis that made allowance for the increased sensitivity of children. However, all exposure pathways other than inhalation of radon daughters constitute only about 1% of the total health risks estimated in the DEIS.

Comment 10: EPA fails to consider cumulative or synergistic effects between radionuclides and toxic metals in its risk assessment. (P-45.18)

Response: EPA disagrees. The cumulative effects of exposure from radioactive materials released from the piles is given in the DEIS (Tables 6-1 to 6-6). The question of cumulative or synergistic effects of radionuclides and toxic metals is both speculative, since neither phenomenon has been demonstrated, and open-ended, since it would require knowledge of all past, present, and future exposures. The Agency addressed the risks it could identify, but not the hypothetical issue raised here. If the tailings are controlled, the issue should be moot.

!Alternative Limits Proposed!

Comment 11: After reclamation, tailings should meet a radon concentration standard at the downwind edge of the tailings equivalent to the radon emission rate. (P-1(2).44, P-1(2).59)

Response: The majority of the health impact of tailings is estimated for populations located at a distance from the tailings. This is effectively limited by a flux standard alone. A radon concentration-in-air limit would serve no significant additional purpose and would require long-term monitoring, which is clearly impractical for the 1000 years contemplated by these standards. The Agency chose a design standard rather than a performance standard precisely to avoid such an unreasonable monitoring requirement. Also see the response to Comment 16, A.1.2.

Comment 12: We recommend that a performance standard of 0.5 pCi per liter be applied upon stabilization of the impoundment. (S-12(H2).2)

Response: See the response to Comment 11, this section.

Comment 13: We recommend a regulatory standard in terms of concentrations of radon decay products, and support the levels prescribed by 10 CFR Part 20 (0.03WL). As an alternative, the NCRP is recommending an exposure limit for radon decay products of 2 WLM per year. (I-6(H2).12, P-29.3, I-25.16, I-28.11, I-4(H2).10, I-4(H2).11, I-6(4).9)

Response: A standard in terms of radon decay products would suffer from the same deficiencies as a radon concentration standard (see Comment 11, above). In addition, the recommended values (0.03 WL and 2 WLM per year) would permit unacceptably high levels of risk (on the order of 3 in 100 lifetime risk of death from lung cancer). The EPA standard is set at a value at least 30 times lower. The NCRP has not recommended the value quoted.

Comment 14: EPA should establish a general performance standard of 0.3 pCi/liter to apply to the maximum individual or, alternatively, at the edge of the pile. NRC would implement such a standard using ALARA. (F-6(2).10)

Response: See the response to Comment 11 regarding "performance" standards. In addition, EPA does not choose to delegate its standards-setting authority to NRC via an ALARA process when there is no difficulty in establishing an appropriate generally applicable numerical standard. We also do not believe that it was the intent of UMTRCA that EPA do so.

!EPA's Assessment Should Include Uncertainties of Estimates and Probabilities of Occurrence!

Comment 15: It is difficult to judge the conservatism in the analysis when only one value is used for each parameter. EPA should perform a quantitative uncertainty analysis on its risk estimates, similar to that applied to EPA's proposed radionuclide release limits for high-level waste repositories (40 CFR 191). (I-9(3).2)

Response: EPA agrees that a quantitative uncertainty analysis of its risk estimates would provide useful insights into the sensitivity of the risk assessment to the uncertainties in the various parameters used for that purpose. However, we believe that in order to be useful, such a study would require careful evaluation of the relevant parameter distributions, taking into consideration that they are mutually interdependent. In the meantime, we believe that the more qualitative perspective gained from experience and consideration of such references as Ho78, Ho70, and Chapter 3 of Wa80, provides a sufficient basis for the rulemaking process.

Ho78 F.O. Hoffman, D.L. Shaeffer, C.W. Miller, and C.T. Garten Jr. Editors, "Proceedings of a Workshop on the Evaluation of Models Used for the Environmental Assessment of Radionuclide Releases", Oak Ridge National Laboratory, CONG-770901, April 1978.

Ho79 F.O. Hoffman, C.F. Baes III, editors, "A Statistical Analysis of Selected Parameters for Predicating Food Chain Transport and Internal Dose of Radionuclides", Oak Ridge National Laboratory, NUREG/CR-1004, ORNL/NUREG/TM-282, October 1979.

Wa80 J.A. Watson, Chairman, "Upgrading Environmental Radiation Data - Health Physics Society Committee Report HPSR-1 (1980)," Environmental Protection Agency, EPA 520/1-80-012, August 1980.

Comment 16: EPA failed to utilize probabilistic risk analysis techniques to assess the realistic potential for misuse. EPA merely states that the possibility of misuse is "real" (RIA at 3-3), without analyzing or even discussing assumptions that purport to lead to such a conclusion. (I-4(3).12)

Response: That the potential for misuse is "real" is amply demonstrated by the large number of instances of misuse documented not only at Grand Junction, Co., but, to a lesser extent, at many other sites. This extensive misuse has occurred in a period of only a few decades. The hazard from these tailings will persist for many thousands of years.

Comment 17. EPA has not adequately addressed the risks from uranium milling tailings. This assessment should include major geologic, climatic, and institutional impacts on disposal facilities. The risks to radiosensitive populations, all exposure pathways, the contributions of radioactive elements other than radon, and other diseases associated with uranium processing. (P-35.6, P-35.7)

Response: EPA disagrees. Satisfying the longevity standard (see the Preamble) requires that events of low probability but high disruptiveness be considered if the design is to provide "reasonable assurance" of attaining design criteria (See Chapter 8 in the FEIS). Each class of events that may affect disposal longevity should be evaluated on a site-specific basis in developing the disposal program for that site.

The risks have been estimated as realistically as possible for all identifiable pathways for radon and radioisotopes found in tailings (See Chapters 4, 5, and 6, in the FEIS, Volume I). Currently available scientific information on radiosensitivity of specific population groups has been incorporated in the models (see Comment 2, A.2.1.2.). Those risks identifiable with radiation or uranium processing have been estimated. Other conditions hypothesized to be associated with radiation or uranium were also considered, but proof of relationship is lacking.

A.2.1 Radiological Health Risk Assessment

!Existing Epidemiology Indicates Hazards Are Greater Than EPA Has Used!

Comment 1: The March of Dimes Birth Defects Study for the Navajo Tribe shows twice the number of still births, miscarriages, infant deaths, congenital or genetic malformations and childhood cancers which are likely caused by tailings pile emissions located in the immediate area. (P-6.1)

Response: EPA agrees there is reason for concern about tailings and has documented these concerns in the FEIS, Volume I. EPA also agrees that there appear to be health problems in the Navaho Nation population. However, there is no evidence that the Navaho Nation problems are related to tailings control. As noted by attendees at the meeting on "Birth Effects in the Four Corners Area" (submittal IV-1-97), reported findings there are preliminary. A number of other variables must be considered, and, to the degree possible, quantified. These include demographic, socioeconomic, exposure, genetic, health care data, etc. Data must be gathered not only for the Four Corners Area but also for similar areas without uranium mining and milling. It will take a fair amount of work to discover if uranium mining and milling is even potentially implicated in the health problems referred to by the commenter. In any case, the control levels in the standard should prevent, to the extent indicated in the FEIS, the adverse effects of uncontrolled tailings.

Comment 2: Recent studies on local communities in or adjacent to uranium mining and milling areas indicate excess adverse health effects and birth defects. (P-1(2).23, P-37.1)

Response: See the response to Comment 1, A.2.1.

Comment 3: Based on known studies in uranium mines and preliminary observations in populations having environmental exposures to uranium mining and milling in the Four Corners area, there is reason to be concerned about the effects of radiation from mill tailings. (P-31.1)

Response: See the response to Comment 1, A.2.1.

Comment 4: The death rate from malignant melanoma in Jefferson County, Colorado which contains a large uranium mine and a plutonium plant, is excessively high. (P-30.10)

Response: The observations on malignant melanoma are not necessarily relevant to the proposed standards. The best evidence is that radiation related skin cancers are basal cell cancers, or, less frequently, squamous cell carcinomas. (H. Martin, et al., Cancer, 25: 61-71, 1970; M. Sevcova, et al., Health Physics, 35: 803-806, 1978). Malignant melanomas, on the other hand, appear most related to ultraviolet (sun light) exposure (Measurements of Ultraviolet Radiation in the United States and Comparisons with Skin Cancer Data, DHEW No. (NIH) 76-1029, National Institutes of Health, Washington, 1975). The risk of melanoma is related to the annual ultraviolet exposure (T.R. Fears, et al., Am. J. Epidemiol, 105: 420-427, 1977).

Comment 5: A study of uranium miners found a 38% increase in the rate of chromosomal abnormalities for the lowest exposure group of less than 100 Working Level Months. (P-30.11)

Response: While there was an increase in chromosomal abnormalities in the study cited by the commenter, the control abnormality rate was low and the numbers of subjects small. It is not known if the reported increase is statistically significant. The significance, if any, of increased chromosomal abnormalities in peripheral blood lymphocytes has not been established. Studies on chromosome abnormalities try to use the changing abnormality rates as biological dosimeters for the radiation exposure. This was done in the study cited by the commenter. However, clinical or hereditary implications have not been associated with these changes.

Comment 6: Dr. John Gofman estimates that a minimum of 450,000 additional persons will die prematurely in the future for each year that a full-scale nuclear power program continues to operate.

Response: The continuation or non-continuation of this nuclear power program is not the subject of this rulemaking.

Comment 7: Our knowledge about the reproductive hazards of low-level radiation contamination of the environment from mill tailings, including the effects of radon and radon daughters, is incomplete. There is no good reason to assume that such effects will be negligible. (P-31(2).1, P-61.1)

Response: See the response to Comment 1, A.2.1.

!Existing Epidemiology Indicates Hazards Are Lower Then EPA Has Estimated!

Comment 8: Epidemiological studies have not detected increased cancers or other health effects associated with elevated levels of natural background radiation, thus risks must be estimated for low level radiation. EPA's linear non-threshold model is conservative. It does not recognize well-known biological repair mechanisms, it ignores increasing evidence of a threshold, and it is not compelled by the data. Therefore, EPA's estimates of fatalities are excessive. (I-6(3).30)

Response: The commenter has confused the ability to prove or disapprove a hypothesis with the validity of the hypothesis. Numerous reports have reviewed the basic requirements of epidemiologic studies of background radiation. In general, in addition to detailed demographic, socio- economic, health statistics and exposure data across the time period involved, they require a base of millions to hundreds of millions of person-years of data to detect the incremental increase in risk projected by current risk coefficients, even for exposure levels around 4 times average background. Charles Land has examined this problem in some detail (C.E. Land, Science, 209: 1197-1203, 1980); see also: E.E. Pochin, Health Physics, 31: 148-151, 1976; S.G. Goss, Health Physics, 29: 715-721, 1975; C. Buck, Science, 129: 1357-1358, 1959; G. Hems, Brit. Med. J., 1: 393-396, 1966. None of the geographic epidemiology studies published to date has been able to meet the necessary criteria. This includes both negative and positive reports.

The commenter also alludes to "well-known biological repair mechanisms". EPA is not familiar with any such mechanisms related to radiation induction of cancer. Although at the cellular level there are known repair systems for sublethal and potentially lethal damage, there are also unscheduled DNA synthesis and error-prone repair systems which have been related to increased transformation of cells. Repair systems affecting survival are not the same as those influencing malignant transformation. The details of radiation inducible repair systems are unknown, but the systems appear to be of the error-prone variety. Any attempt to project the current morass of data on repair at the cellular level as a "well known biological repair mechanism" that will reduce the effects of ionizing radiation exposure is scientifically invalid.

Also see Comments 13 and 14, pp. D-23 and D-24 of FEIS-I, Volume II, for additional information.

Comment 9: The epidemiological work of Dr. Stephen F. Lanes, studying the possible association between lung cancer and radon exposure from mill tailings in Canonsburg, Pennsylvania, concludes that there is no significant correlation, if any, between radon emanations from the tailings and cancer risks. Further, since Dr. Lanes' study established confidence levels, if risks were as large as EPA's model suggests, a correlation would have been detected at Canonsburg. (I-4(3).30)

Response: EPA strongly disagrees. Dr. Lane's study was too small to detect any difference in health risk even if the risk were present. The power of this study to determine a carcinogenic effect, assuming one was present, is only 0.38, i.e., less then a 50-50 chance. Even though Lane calculated (incorrectly) a somewhat greater power, on page 34 of his thesis he states, "This is a relatively low power, however, and, consequently, a negative finding may be attributed to small sample size and should not be considered strong evidence for the null hypothesis of no association". Moreover, we do not agree that this study can be used to test EPA risk estimates. Using the radon daughter concentrations reported in his thesis, we have calculated, using the same EPA risk models as described in the FEIS, what difference in lung cancer mortality due to radon might have occurred in his case and control groups for lifetime exposure. This difference was less than 0.2 cases, not a detectable amount in any epidemiological study, let alone one consisting of fewer than 100 participants.

Comment 10: Several experts have testified that the health effects of radon in the general population are insignificant. (P-29.2, I-4(H2).6, I-22.9, I-4(3).26)

Response: EPA agrees that relevant data bases are not large, most exposure data are relatively poor, and the follow-up period of exposed miners is considerably less than a lifetime. Moreover, there is considerable extrapolation involved in estimating risks for a general population on the basis of occupational health studies. This leaves room for differing opinions. Nevertheless, a considerable body of expert opinion agrees with EPA. The Canadian Atomic Energy Control Board, roughly equivalent to the U.S. Nuclear Regulatory Commission, has recently issued a report, "Risk Estimates for the Health Effects of Alpha Radiation" (INFO-0081)$^{(2)}$ that examines the radon risk question more thoroughly than other published documents. This 323 page report, in contrast to assertions by "experts," provides a full epidemiologic analysis, i.e., a Cox regression analysis of all of the available data, and explicitly states what criteria were used in assessing the individual studies. The report concludes that the best projection model for lung cancer due to the inhalation of radon progeny is a relative risk model with a risk coefficient of 2.3% increase per WLM. EPA has used a relative risk model with a coefficient of 3%. For a general population that includes children, this is not overly conservative. In addition to the Canadian study, the 1980 NAS BEIR committee critiqued risk estimates for radon. Although the committee preferred an absolute risk projection model in which the risk coefficient increased as a function of age, in contrast to the EPA relative risk model where the increased age follows the age pattern of the U.S. lung cancer incidence, their numerical estimate of lifetime radon risk is almost identical, 850 cases per 10^6 person WLM$^{(3)}$ vis a vis 860 cases per 10^6 person WLM$^{(4)}$. We emphasize that due to the uncertainties in the data base, the agreement between NAS, Canadian AECB, and USEPA risk estimates should not be taken as a sign that our risk estimates are precise or even correct within a factor of two. We expect our risk estimates will change as more information becomes available. With time, perhaps, so will those of other "experts."

Comment 11: A 1972 EPA report, "Estimates of Ionizing Radiation Doses in the U.S., 1960-2000 (ORP/CSD 72-1) at 27-28 (1972)" states that uranium tailings as sources of radioactivity were insignificant. (I-12(2).4)

Response: The report cited was based on the rather scanty data available in 1970. Many of the sections of the report are no longer accurate because of the increased data base developed since 1970. For example, in the report of the United Nations Scientific Committee on the Effects of Atomic Radiation, treatment of uranium mining and milling has increased from one half page with no numerical estimates of exposure in 1972 to three or four pages with transport and exposure estimates in 1977(5) and 1982(6). As data have been obtained, the perspective has changed.

!The Assumptions Used By EPA Are Not Conservative Enough!

Comment 12: Several of EPA's assumptions tend to artificially lower the projected population exposure. These include the assumed radon emission rates, the lack of growth in population near the tailings, cover degradation, and the assumption that residents of rural and remote sites produce the same amount of their own food supply as urban residents and therefore ingestion of contaminated locally-grown foodstuffs is minimized. (P-1(H2-2).2, P-1(2).15, P-1(2).16)

Response: Radon emission rates were chosen to be consistent with those used in the NRC GEIS,(8) and are based on a 280 pCi/g radium-226 concentration in tailings and radon emission factor of 1 pCi/m^2-s of radon-222 per pCi/g of radium-226 in the tailings. These values correspond to dry tailings of ore representing grades currently being processed. As indicated in the response to Comment 35, A.2.1, we believe it is more prudent to consider a fixed population than to guess at what the population growth scenario will be in a given area 100 or 1000 years from now. As stated in the RIA (p.3.8) "The goal of long term protection is to provide all reasonable controls for as long a period as the potential hazards remain." The balance of Section 3.3 in the RIA considers the long term isolation of mill tailings, including the possibilities for degradation. In general, uranium mills have not been sited in agriculturally productive regions. Our use of urban factors for individual consumption of home-produced foods is based on the expectation that in such an area an individual uses his or her garden to supplement the home food supply rather than to provide the bulk of it. This is true in rural as well as urban areas. Our intent is to provide reasonable estimates of the food intake, not upper limits. There will be circumstances where those estimates will be exceeded and others where they will overestimate the actual intake of home grown food.

Comment 13: EPA's risk assessment underestimates both exposure and risks per unit exposure. These considerations convince us that the assumption of 75% to equate non-occupational to occupational exposure is, if anything, too low. (P-45(1).25)

Response: The Agency assumed that on the average residents were in their homes 75% of the time, i.e., 18 hr/day. While the Agency agrees that some infants may spend 100% of their time indoors, infancy does not last beyond a year or so and the total exposure estimate over a life would not be unduly increased. The difference is about 1/2 %. Also see the response to Comment 15, A.2.1.

Comment 14: EPA's analysis appears to understate ingestion exposures for areas with greater agricultural productivity than the average values used by EPA. (P-45.21)

Response: See the response to Comment 2, A.2.1.1.

Comment 15: By including (or confusing) occupancy factors, breathing rates, organ sizes, etc., in a unit of cumulative exposure, EPA incorrectly equates continuous residential exposure to 0.01 WL with a cumulative exposure of 0.27 WLM per year. Assuming 100% of the time is spent indoors, the cumulative exposure would be 0.5 WLM per year. (P-9(3).12)

Response: A cumulative exposure of 0.5 WLM per year is obtained if one assumes members of the general population have the same ventilation rate and minute volume 24 hrs per day - 7 days a week, as working miners do 8 hrs per day - 5 days a week. In practice, their breathing patterns are quite different when sleep, light activity, and labor are taken into account(7). Alternatively, one could express radon exposure to the general population in terms of potential alpha energy inhaled per year rather than WLM, since the latter is formally defined only for occupational exposure. While technically correct, such an approach might be less useful. See the response to Comment 3, A.1.3.

Comment 16: Based on EPA's own estimate (DEIS 6-1), the acid leach process only removes 90 percent of the uranium in the ore, and not 93 percent as EPA assumes for the model mill (DEIS 4-8) and bases its risk assessments on. But, 10 percent (vs. 7 percent, as EPA assumes) of the original uranium in the ore means a 43 percent increase of the uranium in the tailings, which means that emissions from the piles will be higher, or risks higher than shown in the DEIS. (P-45.22)

Response: EPA's estimate is based on the best data available. The 90 percent value was numerically rounded off.

Comment 17: One death is too many from cancer or any other disease caused by improper disposal of tailings waste. (P-63.2)

Response: EPA agrees. However, we must decide what is "proper" and "improper" disposal, since society does not have the ability to provide perfect isolation of wastes. That is the purpose of the rulemaking.

!The Assumptions Used by EPA Are Too Conservative!

Comment 18: EPA consistently uses excessive conservatism when determining health effects from radiation exposure. EPA used inflated values for: (1) increased lung cancer cases per WLM, (2) effective exposure time, and (3) equilibrium value. EPA's assumption that a person potentially exposed to radon emissions will live in the same house for 70 years is also conservative. Although EPA estimates someone living continuously next to a tailings pile may experience a lifetime excess lung cancer risk as high as 4 chances in 100, a more realistic estimate yields a risk less than 0.04 in 100. (I-2(2).9, I-1(2).39)

Response:

1. The Agency has detailed in the FEIS and in responses to Comments 10, A.2.1; 8, A.2.1.2; 10, A.2.1.2; and others, the growing scientific consensus of the primary investigators and other scientists that the relative risk model is the appropriate model for lung cancer estimation. Use of this model is not inherently excessively conservative. The inherent errors in the absolute risk model estimates cited by several commenters lead them to underestimate the risk.

2. The commenter has a misconception of how the Agency program for calculating risk operates. The appropriate latent periods and periods of expression are included in the calculation of estimated risk. This is quite independent of the period of exposure, which is, of course, the period when the person is exposed to the radiation source. See Appendix C of the FEIS and related references.

3. The Agency is revising the estimate of equilibrium fraction in the Final EIS. See Comment 14, A.2.1.2.

4. The commenters' use of ICRP Publication 26(9) assumptions concerning occupational exposure patterns is not relevant to environmental exposures. The Agency position on duration of exposure is outlined in an EPA report(7):

> "In these risk estimates it is assumed that the population at risk is subject to lifetime exposure and the distribution of ages is that in a stable (stationary) population (Un75). The Agency recognizes that residential dwellings are seldom occupied by one family group for their lifetimes. However, this has little effect on the ultimate health impact if another family occupies the structure. The health risk to a particular family is a function of the time they occupy the dwelling and to a lesser extent their ages. For most practical purposes, the risk due to occupancy of less than 70 years can be found by taking a fraction of the risk given below as proportional to the years of occupancy. For example, 7-year occupancy would be expected to yield one-tenth the estimated risk of lung cancer due to lifetime exposure, approximately 70 years. Residences which serve primarily as children's or geriatric's homes would be obvious exceptions."

It is prudent to assume that a dwelling will be occupied by someone with about the same mix of ages, for extended periods, or that there will be a similar occupied dwelling at that location.

Comment 19: EPA's risk estimate for a maximally exposed individual is based on unrealistic assumptions as to the location of the individual, length of exposure, and the magnitude of the exposure. (I-4(3).28, I-4(3).57)

Response: EPA has considered the risk to an individual at a number of distances from the pile (e.g., table 6-1). We do not expect that every tailings pile will have an associated individual living 600 meters from its centroid. Our base case for risk assessment is an individual living a lifetime under a given set of exposure conditions. While we realize that it would be unusual for a person to live a lifetime at the same location, we believe that it is appropriate to consider the risk to an individual under these circumstances. This point is discussed further in the response to Comment 18, A.2.1.

Comment 20: EPA's dispersion model overestimates close-in radon concentrations by a factor of 3 to 10, thereby overestimating risks to nearby residents by as much as an order of magnitude. (I-4(3).43, I-6(4).8)

Response: The sector-averaged Gaussian plume model has been used as the basic work horse of local dispersion estimation for years. In 1977, the participants of a group assessing atmospheric transport of radionuclides (Ho78) concluded that for distances out to 10 km in reasonably flat terrain and given good local wind observations that, "Accuracy for the usual annual average concentration is about a factor of 2." At distances between 10 to 100 km, they concluded that accuracy could be about a factor of 4 for long term averages. While there is considerable uncertainty in such dispersion estimates, they are based on an empirical approach that is inherently unbiased so that they are as likely to underpredict as to overpredict.

It should be noted that we are not modeling background concentrations of radon. While it may be difficult to observe the increment of radon above background due to the tailings pile at distances greater than 1 km from the pile, there is no reason to believe that conservation of mass (or activity) does not continue to be a valid concept. Once released to the atmosphere, radon continues to disperse until it is removed by radioactive decay. In conclusion, we believe that for a given source term and set of wind data, the sector-average Gaussian dispersion estimates provide a reasonable basis for calculating local concentrations of radon.

Ho78 F.O. Hoffman, D.L. Shaeffer, C.W. Miller, and C.T. Garten Jr., "The Evaluation of Models Used for the Environmental Assessment of Radionuclides Releases," Proceedings of a Workshop held at Gatlinburg, TN, September 6-9, 1977, Oak Ridge National Laboratory, Oak Ridge, TN, CONF-770901 1978.

Comment 21: We suggest that EPA reconsiders its entire risk calculation for radon to bring the calculations into the range of a true "best estimate," by considering the actual levels of radon in ambient air in conjunction with naturally occurring background radon levels. (I-24.4)

Response: The commenter has perhaps missed the point of this rulemaking. The purpose of these standards is not to regulate naturally-occurring background radon levels in ambient air, but to regulate radon from uranium mill tailings. For this reason, we calculate, for example, the number of lung cancer deaths from radon emissions from tailings piles, not those from radon emissions from other sources.

Comment 22: Radon emanating from tailings is an insignificant fraction of natural background emissions. The doses and risk to the general population from radon and its decay products from tailings can only be predicted by theoretical dispersion models since elevated concentrations cannot be measured beyond approximately one-half mile, and the estimated incremental doses and risks are insignificant compared to background and other sources. (I-6(3).28, I-6(3).36, I-6(H2).29, I-4(3).27, I-4(3).29, I-25.14, I-4(H2).8, P-28.2)

Response: While experimentally it may be difficult to demonstrate the increment above background due to a tailings pile at a distance greater than 1 km from the pile, there is no reason to believe that conservation of mass (or activity) does not continue to be a valid concept. Once released to the atmosphere, radon should continue to disperse freely until it is removed by radiological decay. In conclusion, EPA believes that for a given source term and set of wind data, that sector average gaussian dispersion estimates provide a reasonable basis for calculating local concentrations of radon. Also, see response to Comment 10, A.3.1.

Comment 23: The inherent problem with EPA's approach to standards development rests in the hypothetical "worst case" models EPA preferentially chooses to evaluate. Regarding calculated health effects, EPA conservatively overestimates the impacts by a factor of at least 100 by assuming hypothetical "worst case" scenarios. Realistic scenarios are not entertained. (I-1(2).2)

Response: The comment is not correct. EPA did not consider "worst case" models, but instead used models which describe average conditions. The Federal Register notice of final standards (as well as various parts of this response to comment) details our response to the allegation that we overestimated health effects.

Comment 24: The cumulative effect of EPA systematic overestimation of the factors which determine potential health effects is to overestimate risks by a factor of 60. Thus, all the benefits EPA claims for 95 percent radon control or a 20 pCi/m^2-sec standard could be achieved simply by using the correct factors. (I-4(3).50)

Response: The commenter expressed the view that the models used by EPA overestimate potential health effects from mill tailings. In the aggregate, these overestimates combine to yield an overestimate factor of about 60. These factors are:

Area of model tailings piles	1.4
Radon flux per unit activity	1.8
Transport and dispersion models	5.0
Equilibrium for radon decay products	1.7
Risk of lung cancer	3.0
Population near tailings piles	unknown

We will discuss each of these factors in turn.

The radon emission from tailings is directly related to the surface area covered by tailings. EPA used the same area that NRC used in their FGEIS(8), 80 hectares, to estimate radon emissions. The AMC prefers 50 hectares, and points out that NRC(10) later revised its estimate to 50 hectares. However, current projections of uranium production indicate that very few new mills or piles, if any, will start up between now and the late 1990's. Thus, essentially all radon emissions will be from existing piles, which have an average area of 68 as shown in the FEIS. In addition, radon is emitted from areas contaminated by windblown tailings. We conclude the area of piles has been overestimated by at most a factor of 1.16.

The emission rate of radon per unit area of tailing is directly related to the activity of radium-226 in tailings. Several factors which are not well understood influence this emission rate. In the report cited above, the NRC concluded: "Considering the variation observed under differing conditions at a number of sites, the staff has elected to apply conservative specific flux values of 0.3 [pCi of radon-222 per square meter-second/pCi of radium-226 per gram of tailings] for wet tailings and 1.0 for dry tailings and to count moist tailings as dry in making the calculations." EPA agrees with this conclusion and believes no correction is needed for this factor.

Regarding transport models, measurements are consistent with the transport and dispersion models we used. This is discussed in detail in the FEIS. The method used by EPA has been the basic work-horse of local dispersion estimation for years. In 1977, the participants of an expert group assessing atmospheric transport of radionuclides (Ho78, see page 2-14 for citation) concluded that, for distances out to 10 km in reasonably flat terrain, and given good local wind observations: "Accuracy for the usual annual average concentration is about a factor of ± 2." Furthermore, these dispersion estimates are based on an empirical approach that is inherently unbiased and that should therefore be as likely to overpredict as to underpredict.

It should be noted that we are not modeling background concentrations of radon. While it may be experimentally difficult to demonstrate the increment above background due to a tailings pile at distances greater than 1 km, there is no reason to believe that the basic physical principle of conservation of mass does not continue to be valid. Once released to the atmosphere, radon, which is a chemically inert gas, disperses freely until it is removed by radioactive decay. We conclude that our dispersion estimates provide a reasonable basis for calculating atmospheric concentrations of radon.

There appears to be a misconception about the conditions to which EPA's assumption of a 0.7 equilibrium fraction for radon decay products apply. Most of the data cited by commenters to support a lower equilibrium fraction are based on the diffusion of radon into houses from underlying soil, in which radon the initial decay product equilibrium fraction is zero. For the airborne radon from piles considered in EPA's estimates, the decay product equilibrium fraction in outdoor air approaches 1.0, beyond the near vicinity of a pile. After taking account of periods of time an individual spends outdoors, and periods of time a house is well-ventilated by outdoor air, we conclude use of a 0.7 equilibrium fraction for airborne radon is more than justified at distances far from tailings piles. This value is therefore retained for calculations of total impact of radon releases from piles. Very close to tailings piles, however, the decay product equilibrium fraction in outdoor air is low. We conclude, therefore, after taking the same indoor/outdoor factors into account, that an average effective radon decay product equilibrium fraction about one half as large is probably more appropriate next to piles. This lower value should be applied to estimates of maximum individual risk next to piles.

The EPA estimate of lung cancer risk from radon decay products is based on studies of uranium and other heavy metal miners, is consistent with recommendations of the NAS BEIR Committee(3), and is within 20% of the value recommended for use in a recent, exhaustive study conducted in Canada (Ref). See Comment 18, A.2.1. EPA used two regional populations for its risk estimates; the first population, identified as for a "remote" site, was hypothetical, and was taken directly from NRC's FGEIS.(8) The second population, identified as for a "rural" site, is that for the Edgemont, S.D. site, based on 1970 census data. We assumed that a mix of six "rural" and 17 "remote" sites would properly represent the 23 sites modeled in the DEIS. Since publication of the DEIS the Agency has received the results of a population survey for all 52 mill tailings sites performed for us by Battelle Pacific Northwest Laboratories.(25) This survey, which was limited to individuals within 5 km of the piles, shows that the total population at the 26 active sites was 2054 within 2 kilometers of the edge of all active tailings piles, and 14,737 within 5 kilometers. We also used 1970 census results to re-evaluate populations from 5 to 80 km of the 26 active sites.

These data indicate that our initial estimate of health effects to populations within 80 kms is correct, if we assume that there will be no increases of populations at these sites. Our estimates of risk to more distant populations, i.e., to the remainder of the United States, are also unchanged.

In summary, we do not believe the total health effects in the DEIS have been overestimated. The factor of about 1.16 due to slightly changed average pile area is likely to be negated by normal population increases well within the first century of the lifetime of the hazard posed by these tailings. The estimate of maximum individual risk for a model pile is affected principally by our assumption for the equilibrium fraction for radon to radon daughters, and should be reduced by 50%. We believe these changes are insufficient to warrant changing our basic conclusions regarding the risk from tailings or these standards.

Comment 25: EPA's estimate of 12 to 14 fatalities per year by the turn of the century is excessive. In addition to the conservative risk model used to estimate risk, EPA overstates the amount of tailings that will be in existence and failed to recognize that radon emanations will increase only marginally, as most of the new tailings will be placed on existing tailings piles. (I-6(3).31)

Response: The comment is correct regarding tailings projections and the use of remaining capacity in existing tailings piles. We have made the appropriate corrections in the FEIS.

Comment 26: EPA's radon risks are based, in part, on the NRC's post-operational source term for a model mill. NRC has determined that its source term is unrealistically high, because of over-estimating the area of tailings. Thus EPA risk estimates are high by about a factor of 1.3. (I-4(3).41)

Response: See the response to Comment 24, A.2.1. EPA's area (80 hectares) is closer to the actual average area of existing piles (70 hectares) than the new NRC(10) model area (50 hectares).

Comment 27: By ignoring such factors as the wet portion of the pile, EPA overestimates the amount of radon released from active tailings by a factor of three to six. (I-6(4).10)

Response: Consistent with the NRC GEIS(8), EPA has assumed "...that during operations, one-fourth of the tailings area is covered by water, and another one-eighth is wet..." (p. 4-7). No radon is assumed to be released from these portions of the pile during the active phase of milling operations.

Comment 28: EPA's radon source term is based, in part, on the assumption that the radon emission rate per unit area is 1 pCi/m^2-sec per pCi/g of radium-226/g of soil. Based on EPA's measurements at inactive tailings, 0.5-0.6 pCi/m^2-sec per pCi/g of radium 226/g is the best estimate. Thus, risks are overstated by a factor of 1.8. (I-4(3).42)

Response: These measurements are for piles which still contain moisture. The EPA estimate is for tailings which are completely dry. See the response to Comment 24, A.2.1.

Comment 29: EPA's risk estimate for population exposure is based on unrealistically high population densities around existing mills. (I-4(3).49)

Response: Since preparing the DEIS, EPA has obtained complete current data for the populations in the vicinity of uranium mills (see the response to Comment 24, A.2.1. and Appendix E of the FEIS I-Volume I). The results show fewer people very close and more people at intermediate distances. The population risks have been recalculated accordingly.

Comment 30: EPA's radon daughter level of 0.02 WL for indoor structures is five times as conservative as the limit NCRP recommends for remedial action. (I-4(3).58)

Response: The NCRP has not published any recommendations on a limit for indoor radon. Furthermore, the Agency notes that such a limit, i.e., 0.1 WL (5x.02WL) could correspond to a residential exposure of 2 WLM per year at an occupancy factor of 0.75. i.e., 18 hrs per day. This is exactly half of the occupational exposure limit for underground uranium miners. Typically an underground uranium miner works in this environment for less than twenty five years.

!The Assumptions Used By EPA Are Questionable!

Comment 31: EPA's use of occupational studies of uranium miners to estimate risk to the general population is questionable because of uncertainties in exposure, age-dependent factors, behavioral differences, and exposure to other toxins. (P-45.25)

Response: We recognize that extrapolation of data based on the experience of underground miners to the general population is not straight forward. This problem has been discussed in FEIS-I, Volume I, reference (7). Although the miners' age and sex distribution differs from that of the general public, it is the only meaningful data base for human cancer due to radon and has been used by the ICRP and UNSCEAR and other authorized bodies.

We do not believe "other toxins" etc., in uranium miners is a particularly relevant issue and call attention to detailed comments on etiology of lung cancer in uranium miners in Heupers' Monographs: Occupational Tumors and Allied Diseases by W.C. Heuper, C.C. Thomas, Baltimore, 1942 and Occupational and Environmental Cancers of the Respiratory System by W.C. Heuper, Springer-Verlag. New York, 1966.

Comment 32: EPA fails to use age adjusted life tables for the incidence of lung cancer. (P-45.20)

Response: The comment is incorrect; we used age-adjusted life tables. EPA introduced the use of age-adjusted life tables for the analysis of radiation risks (J. R. Cook, et al., A Computer Code for Cohort Analysis of Increased Risk of Death, EPA 520/4-78-012, USEPA, Washington, 1978, and B. M. Bunger, et al., Health Physics, 40: 439-455, 1981.)

!Additional Comments!

Comment 33: Since EPA uses NRC's Model Mill, a comparison of EPA's and NRC's projected doses and estimated risks should be provided. (S-6.2)

Response: Both EPA and NRC use adequate risk estimates. We do not see the relevance of the comment to the rulemaking.

Comment 34: EPA failure to specify dose levels of gamma radiation make it impossible to evaluate EPA determination of gamma risk. (P-45.24)

Response: EPA stated the risk coefficients based for gamma doses (FEIS Tables 6-1 and 6-2. These can be used to estimate doses from the risks EPA published.

Comment 35. EPA failed to adjust their risk estimations for population growth. (P-45.20)

Response: EPA agrees that population changes have some impact on health effects estimates. However, even for the same total population, changes in structure of the population pyramid can mask the radiation effects. EPA feels that such changes can be usefully incorporated into the analysis only when it is possible to make realistic demographic projections for a specific area. Since over the time frame of interest, greater then 1000 years or even the shortest time span relevant to those standards, 200 years, demographic projections are as likely to be too high as too low. We do not believe inflating the population at risk by assuming a constant population growth of a few percent per year would serve a useful purpose in considering the adequacy of these standards.

A.2.1.1 Exposure Pathways

!*Omitted Pathways*!

Comment 1: Several exposure pathways including use of contaminated water, grazing and farming on contaminated land, airborne particulates, and releases from accidents, flooding, and misuse are not addressed because EPA considers them "unlikely". They should be assessed. P-13(2).4, P-15(H2).2, P-1(H2-2).5, P-19(H2).1, P-30.3, S-6.4, P-1(2).19)

Response: EPA disagrees. While the impact of airborne particulates has been addressed in the DEIS, the assessment of the other exposure pathways is so site-specific that in our opinion a meaningful generic assessment is not possible. It is our expectation that any potential impact of these pathways would be the basis for appropriate site-specific control measures.

Comment 2: EPA's model underestimates the fraction of food grown in the close-in assessment area. Further, the transfer factors used to estimate uptake of radionuclides by vegetation probably result in underestimating ingestion dose by a factor of 10-1000. (P-1(2).17)

Response: As indicated in the response to Comment 12, A.2.1, EPA considers the typical siting of a uranium mill to provide conditions where an individual living near the facility will supplement other sources of food with a garden rather than home produce the major portion of his or her food supply. The soil to plant transfer factors we have used are based on values reported in the literature which are relevant to growing conditions which might reasonably be expected in normal agricultural practice. While we recognize that under particular conditions higher transfer factors can be measured, we do not believe they are appropriate for our assessments.

Comment 3: It is unclear from EPA's supporting documents how much indoor exposure is caused by tailings radon. Numerous studies have found significant radon exposures in homes far removed from any tailings. (I-4(H2).9)

Response: EPA's calculations in the DEIS are all for radon from the tailings pile. At distances far removed from the tailings, the radon released from the tailings pile makes a small but finite contribution to the total radon concentration (see response to Comment 20, A.2.1. EPA is not suggesting that tailings piles are the sole source of environmental radon.

Comment 4: Doses associated with ingestion are not necessarily small, as stated in the Federal Register, p. 19588. EPA should change this to "are generally smaller" than doses due to inhalation. (F-3(2).6)

Response: EPA realizes that "small" is a relative term and has changed the phrase to "smaller than." It should be noted that compared to effects due to inhalation radon progency, estimated effects due to inhalation ingestion of particulates are at least a factor of 100 smaller.

Comment 5: Details of the assumptions used in atmospheric dispersion of radon are not lucid. (P-9(H1).5)

Response: EPA believes that the material presented in Chapter 4 and 5 of the DEIS, together with reference[7], should be sufficient to explain the methodology and define the parameters used. The response to Comment 20, A.2.1 might also be helpful.

A.2.1.2 Risk Models

!EPA's Explanations Are Unclear!

!The Risk Models Used By EPA Are Not Conservative Enough!

Comment 1: EPA's estimate of lung cancer attributable to radon decay products are too low by a factor of 25. The risk of lung cancer in the general population due to radon is about 2.5 x 10^{-3} per WLM, rather than Evans' estimate of only 10^{-4} per WLM. (P-19(H2).2, P-19(H2).5)

Response: The commenter is in error. He compared his estimate of 2.5 x 10^{-3} cases/WLM with the Evans, et al.(11) estimates of 1 x 10^{-4} cases/WLM when discussing radon daughter related lung cancer risks. The Agency does not and has not used the Evans, et al. estimates. The Agency estimated 9.6 cases x 10^{-4}/WLM (P. C-12 in the DEIS).

Comment 2: EPA's lung cancer risk estimates are based on a non-smoking healthy adult. In order to truly protect the population, EPA should take into account the most radiosensitive members of the population. (P-1(2).14, P-30.1, P-13(2).1)

Response: EPA disagrees. Neither risk coefficient nor estimate of risk was based solely on non-smokers, or smokers, or any particular age group or other group at special risk. All are included in the overall risk estimate. Age specific respiratory rates, lung volumes, and deposition are included in the Agency model for radon daughter related lung cancers. See Comment 4, A.2.0 and reference (7).

Since the Agency uses a relative risk model with current age-specific lung cancer mortality data, all attributable sensitivities are built into the model. As Lundin, et al. (F.E. Lundin, et al. Health Physics, 16: 571-578, 1969) showed, the relative risk in non-smoking miners was the same as that in smoking miners. [4.0 vs 3.9, at that time]. As long as the relative risk coefficient stays the same, and we have no evidence that it changes with age or sex, the risk will be the sum of the constant relative risk times the age-specific mortality rate for each group of varying sensitivity.

This is numerically identical to the relative risk coefficient times the age-specific mortality rate. So, even though individual groups of varying sensitivity are not specifically identified, they are averaged into the calculations of lung cancer risk.

Comment 3: EPA's population risk estimates are based on extrapolations from earlier, less conservative uranium miner data. (P-1(2).13, P-30.1, P-41.3, P-13(2).1)

Response: As stated in Section 4.4.1 of the FEIS for inactive uranium processing sites (FEIS-I, Volume I) we recognize that estimates of risk to the general population that are based on occupational exposure are not exact. Nevertheless, we believe they are useful for examining the risk potential from inactive tailings piles and other radon sources. The comment seems to be based on the thought that low dose rates and low doses are intrinsically less damaging, per unit dose. Although this is being debated for lightly ionizing radiations, there is a consensus by radiation scientists that the carcinogenic effects of highly ionizing radiations are not reduced at low doses and low dose rates(3),(4).

Indeed, for radon, there is evidence that at high exposure, effects per WLM are less than at low levels. For these reasons, we believe a linear extrapolation of low-dose occupational data to environmental levels is not unduly conservative. Moreover, the lifetime cumulative exposure at 0.015 WL is about 20 WLM, not a great deal less than cumulative exposures of miners (60 WLM) who have died of radiogenic lung cancer(12). The increased number of lung cancers observed in Ontario uranium miners in the range from 0 to 30 WLM, while not statistically significant, is fully consistent with the risk observed in these miners at much higher levels of exposure(12),(13). Finally, we reviewed other potential causes of lung cancer associated with hard rock mining in(7), and concluded that there is no evidence that anything other than radon decay products are the cause of the excess lung cancer that has been observed in persons working in a variety of mines have a wide range of suspected co-factors for carcinogenesis. A recent report by the Ontario Government arrived at a similar conclusion(14). Also see response to Comments 4, A.2.1.1 and 9, A.2.1.2.

Comment 4: EPA should use a Quality Factor of 20, rather than 10, in assessing lung cancer risks from alpha radiation to populations exposed to uranium tailings. (P-1(2).11, P-1(2).12, P-1(H2-2).1, P-30.1, P-41.2, P-45.16)

Response: Because quality factors are largely an administrative device to regulate occupational exposures, EPA does not use them in risk assessments but proceeds directly from basic data on dose (in rads) and effects per rad for the same evaluation, to the extent possible, using the life table analysis outlined in Appendix C of the DEIS. Risk factors, for low and high LET radiation, are shown in Table C-1. For the special case of radon daughters, EPA does not attempt to calculate lung doses but makes estimates the risk in terms of exposure to radon daughters.

Comment 5: Some research suggests that effects at low levels of exposure may be higher than those at higher doses and dose rates. (P-33.5, P-30.1, P-45.16)

Response: Although there is evidence for radon daughter exposure that the carcinogenic response per WLM at exposures greater than a few hundred working level months is less than at lower levels, there is no conclusive data indicating a significant departure from linearity at the levels we used to estimate the risk coefficient. Moreover, sampling uncertainties in the epidemiological data are so large at low exposures that a somewhat greater response would not be apparent. Given the uncertainty in the miner data and its application to a general population, any small departure of the response from linearity is unlikely to change the risk estimates significantly.

!The Risk Models Used By EPA Are Too Conservative!

Comment 6: EPA's radiation risk coefficients are higher than the "best estimates" of ICRP and NCRP by a factor of approximately six. We strongly urge EPA to consider judging "unreasonable risk" by the 100 mrem/year dose used by the ICRP. (I-4(3).21, I-31.1)

Response: The commenter alludes to statements by their consultant Dr. Leonard D. Hamilton from the Brookhaven National Laboratory (see pp. 28-29, 62 of docket IV-D-87), who examined three other risk estimates and concluded that the EPA estimate is too high by a factor of 6, (Hamilton pp. 22-24, 26). The validity of Dr. Hamilton's analysis of EPA and other estimates should be considered on the basis of their comparability. Dr. Hamilton selected four risk estimates for comparison but did not explore the assumptions on which they were based. Following his notation we have done so below to show their lack of comparability.

I. EPA-890/10^6/WLM
a. assumptions: lifetime exposure from birth (0-110 yrs. with actuarial probability of death due to all causes in this interval)

b. a relative risk of 3%/WLM

The correct EPA estimate should be 860/10^6/WLM given at the top of page C-12 of the DEIS.

II. ICRP (e) - 150-450/10^6/WLM (ICRP-Report 32)$^{(15)}$
assumptions:
a. risk of 5-15/10^6/yr/WLM
b. mean manifestation period of 30 years
c. exposure from age 18 to 65

This epidemiology based estimate of the ICRP is not directly comparable to EPA's. The periods of opportunity for expression in the EPA model are greater since exposure is considered to start at birth and the mean life expectancy is 70 years. While the numbers cannot be compared because of differences in age structures and competing risks in the two populations, a first approximation could be made by doubling the ICRP estimate to account for the more extended period for expression. In this case the ICRP estimate would be equivalent to 300-900/10^6/WLM.

It should also be noted that the ICRP assumption of an annual risk 5-15/10^6/yr/WLM is an estimate based on values ranging from 2 to 20/10^6/yr/WLM, which were averaged over all age periods during occupational exposure. Their 2-20/10^6/yr/WLM is the range of estimates they took from epidemiologic studies. The true range is greater since Archer(16) documented a range of 1.4 to 35.0/10^6/yr/WLM and BEIR III documents a range of 6-47/10^6/yr/WLM. The ICRP estimate is perhaps a factor of 2 too low for occupational exposure and a factor of 4 too low for valid comparison with the EPA estimate.

III. NCRP - 80-200/10^6/WLM (unpublished referred to by the commenter) assumptions:

a. 10/10^6/yr/WLM
b. no lung cancers before age 40
c. induced cancers disappear exponentially with a halftime of 20 years
d. lifetime exposure from birth (0-85 + years)

While EPA can not use data from an unpublished draft report in support of rulemaking, this estimate can be compared to EPA's in the discussion of comments. The NCRP model has a unique feature not found in other lung cancer risk models, i.e. radiation induced lung cancers disappear or become unavailable for expression with time. Mathematically a function is introduced which removes cancers exponentially with a halftime of 20 years. We do not know why this function is introduced or where it is supported by valid observations and analysis. We do know that if this function is removed, the NCRP estimate increases from about 80-200/10^6/WLM to 200-500/10^6 WLM. Moreover, the NCRP estimates an average of 10/10^6/yr/WLM lung cancers could occur. As noted above, Archer(16) documented a range of 1.4 to 35/10^6/yr/WLM and BEIR III, 6 to 47/10^6yr/WLM. It is not certain to what extent NCRP considered the entire range of risk estimates but their risk coefficient 10/yr/WLM is about half of the BEIR-80 risk coefficient (averaged for all ages). In addition, absolute risk coefficients should be weighted by the length of the follow-up in the study, since for less than life time follow-up the absolute risk coefficients increase with increasing length of observation, (BEIR(3),(17). For example, a weighted average for exposures to less than 500 WLM in Archer's paper yields about 17 cases /10^6/yr/WLM. It is likely that the NCRP estimate is another factor of two lower than it should be.

IV. ICRP(d) - 45-138/10^6/WLM (ICRP-32)

The ICRP dosimetric approach is subtle. As ICRP Report 32 points out, their risk concept assumes a proportional relationship without threshold between the dose to relevant target tissues and the associated excess probability for the induction of cancer. ICRP 32 then continues, "On the basis of this concept the risk - relevant dosimetric quantities for radon daughters in the lung are the mean dose or dose equivalent to the two target tissues mentioned above, the basal cell layer in the tracheo-bronchial (TB) region and the mean dose to the epithelium in the pulmonary (P) region." ICRP 32 then uses dosimetric models to calculate the dose equivalents of interest.

In these, assumptions are made that may or may not be either correct or relevant. These uncertainties coupled with ICRP assumptions on weighting factors and quality factors leads to very uncertain conclusions.

However, even if these models are correct, ICRP's use of the mean dose-equivalent for bronchial tissue reduces the REM/WLM by about a factor of 3 since the dose equivalent in the region of the lung where most cancers develop (lobar, segmental and subsegmental bronchi) is about 3 times higher than the mean dose calculated in the models referenced by ICRP 32. Likewise ICRP split the risk weighting factor for lung cancer between bronchi and pulmonary lung, so that each has 50% of the risk originally calculated by ICRP for the lung. This reduces the REM/WLM by a factor of two. Since no radon daughter-related cancers have ever been observed in the pulmonary lung, it is unfortunate that 50% of the risk is assigned there, thus reducing their risk estimate for bronchi cancer by a factor of 2. Correcting for these ICRP assumptions would increase their risk estimate to about 270-828/10^6/WLM. Adjustments for lack of follow-up in the studies from which ICRP derived its estimate of $1.2x10^{-2}$ cancers/Sv ICRP 26 would increase the risk still further.

Dr. Hamilton is in error when he states that the ICRP or NCRP would argue that the EPA estimate is 6-10 times too high. The ICRP estimates are not comparable since EPA did not estimate occupational risk, and age of exposure and period of expression are different. When ICRP and NCRP estimates are appropriately adjusted they are not too inconsistent with EPA's estimates.

There is no evidence in Dr. Hamilton's analysis that shows that EPA estimates are overestimated. It shows rather that different models and assumptions give different answers. The Agency feels the weight of evidence supports the EPA and BEIR-80 estimates. Estimates by the ICRP and NCRP are likely to underestimate the risk whether to miners or to a general population.

The commenter contends that Dr. Hamilton's conclusions are consistent with those of other experts and then cites NCRP members' conclusions. While this may be true, Dr. Hamilton's conclusions are not consistent with those of the experts collecting the data in the studies and analyzing the raw data. Nor are they consistent with analyses agreeing with EPA's, e.g. Risk Estimates for Health Effects of Alpha Radiation by Duncan C. Thomas and K.G. McNeill, Atomic Energy Control Board Report, INFO-0081 and reference (3). The Agency prefers to rely more on the opinion of primary investigators in developing its risk coefficients rather than second or third hand estimates from consensus reports.

Comment 7: EPA's radon risk estimates are based almost entirely on EPA's study of indoor radon in Florida, not the work of the BEIR committee and UNSCEAR as stated in the DEIS. EPA's risk model is based on unrealistic estimates of normal background incidence of cancer in non-smokers and projects equivalent fatal cancers for equal doses to lung and whole body. (P-9(3).14)

Response: The commenter is in error in the statement of the basis for the radon risk estimate. The statement in the DEIS is on page C-6, "The risks and effects on health from low-level ionizing radiation were reviewed for EPA by the National Academy of Sciences in reports published in 1972 and in 1980.(18),(3) We have used these studies and others to estimate the risks associated with the radiation doses calculated in this report." This was done and as can be seen in the response to Comment 10, A.2.1.2 and by comparing references(7), (FEIS-I, Volume I), and the DEIS. The Agency has continually modified its risk estimates as new data becomes available. We have also considered new reviews of health risk which have been published. This does not, however, mean that we have necessarily adopted their conclusions. See the response to Comment 6, A.2.1.1.

The comment on non smokers is apparently related to the commenter's interpretation of selected data on lung cancer mortality and smoking habits. The relevance of the discussion to EPA estimates is not immediate. For example the commenter's estimated risk of death for nonsmokers is 0.6%. Risks are more likely 1.05% in males and 0.0058% in females. (Calculated using 1966-68 ratio of mortality in smokers and non smokers from J.E. Enstrom, JNCI, 62: 755-760, 1979 times the lifetime risk i.e., probability of dying at birth, due to respiratory cancer in DHEW Publication No. (HRA) 75-1150, United States Life Tables by Cause of Death, 1969-71, NCHS, 1975). Effective use of these data, given the continual rise in lung cancer mortality in non smokers (J.E. Enstrom, JNCI, 62: 755-760. 1969) and the likelihood that relative risk may be significantly higher in non smokers than in smokers (E.P. Radford, pp. 151-163 in Banbury Report 9: Quantification of Occupational Cancer, Cold Spring Harbor Laboratory, 1981), is not possible now but is likely in the future. However, since the EPA relative risk model uses age-specific mortality data in a life-table calculation for smokers and non smokers both male and female, the lung cancer incidence in non-smokers does not have a large impact on the overall risk estimate.

The commenter's comparison of fatal cancers for lung and whole body exposure, based on arbitrary organ and whole body risk weighting factors derived by ICRP for regulation of occupational exposure, with the EPA radon daughter related lung cancer estimate is not relevant. Differences in the basis of each derivation prevent a commensurable comparison. Any such comparison is strongly dependent on what is assumed as the dose (in rads) per WLM. We believe this is an unknown parameter even though, as the commenter points out, many persons assume 1 WLM is equal to 10 rads. We also point out that 25 years of occupational exposure can not be compared to a lifetime exposure period to the general population on a one to one basis.

Comment 8: EPA's estimates of radon risk are at the high end of the range of estimates, and might be on the order of a factor of ten or more high. (P-9(H1).7, I-4(3).46, I-4(3).47, I-4(3).48, I-25.15, I-25.10)

Response: Several commenters have referenced statements by a consultant to the American Mining Congress, Dr. Leonard Hamilton, whose analysis will be addressed here and was previously addressed on our response to 6, A.2.1.2. The commenter states that EPA's estimate of 3% increase in lung cancer/WLM is not explained and Dr. Hamilton derives an estimate of 0.8% to 1.8% from BEIR III and calculates an average of 1% (Hamilton p. 19-21A).

The EPA risk estimates for the general public are referenced by a footnote: "(1) See Indoor Radiation Exposure Due to Radium-226 in Florida Phosphate Lands (EPA 79a) for greater detail of such an analysis."

Dr. Hamilton's estimate of relative risk derived from BEIR III considers only the U.S. and Czech uranium miners, relative risks 0.8% and 1.8% per WLM respectively. We note that BEIR III also included a relative risk estimate for the Newfoundland Fluorspar miners. If this relative risk of 8.0% per WLM is included, the average relative risk for the three groups is about 3.5% per WLM. This is about 3 times Dr. Hamilton's estimate of 1% per WLM. Archer, in the paper quoted by Dr. Hamilton(16) estimated relative risks ranging from 1.0% to 5.1% per WLM for groups exposed to cumulative WLM ranging from 21 CWLM to 488 CWLM (p. 354) and concluded (p. 356) for exposure rates of 0 to 0.01WL and up to 3 CWLM; the relative risk could be 3.1% per WLM. For higher exposure rates, 0.01 to 0.35 WL, 3.1 to 100 CWLM he estimated the relative risk could be 2.8% per WLM. These assessments were after EPA's and were independent of ours.

Hewitt in a paper in the same proceedings(12) calculated relative risks of 2% to 2.5% per WLM for his study of Canadian uranium miners. The most recent unmodified preliminary relative risk estimates for the Canadian miners are Bancroft, 2, 264 miners, 44.5 CWLM average exposure relative risk 3.2%/WLM, Elliot Lake, 12,294 miners 31.1 CWLM average exposure; relative risk 2%/WLM (J.Muller, et al., Study of Mortality of Ontario Miners Part 1, Ministry of Labour, Toronto, May, 1983).

These values are similar to EPA's estimate of 3% which was also documented in the same proceedings(19). Dr. Hamilton also cites a paper by Myers, et al. with a figure showing a range of 0 to 1.8% relative risk per WLM. Myers(20) in turn states that his Fig. 3 was derived from Table 1 of Archer, et al. (Archer, 1979). However, the values of relative risk listed by Archer of 5.1% and 2.9% in Canadian miners; 3%, 2.3% and 2.4% in Czech miners and 2% in U.S. miners do not seem to be represented in the figure. Perhaps if the full data set was represented the interpretation might be different.

In an extensive review of the health effects of alpha radiation, the Canadian Atomic Energy Control Board(2) selected a relative risk projection model and concluded the best estimate of excess relative risk for the radon exposure data was 2.28%, ± 0.35% and that this was unlikely to underestimate the excess risk at low doses by more than a factor of 1.5. They further concluded the risks from radon daughters and smoking were intermediate between multiplicative and additive but on the balance chosen to multiplicative. Whittemore and McMillan (see page 2-31 for citation) concluded for U.S uranium miners radiation exposure and cigarette smoking were multiplicative risks. There does not appear to be any valid reason for EPA to change its risk estimate for radon daughter exposure. Dr. Hamilton's conclusion that 1% relative risk per WLM has not been justified. See Comments 6 and 10, A.2.1.2 for supplemental discussion.

Comment 9: EPA's published estimates of health risk from radon are excessive and unsupported. (I-6(3).27, I-6(H2).5, I-24.3, I-4(H2).6, F-3(2).8)

Response: EPA disagrees. See Comments 6, 8 and 10, A.2.1.2; 18, A.2.1.

Comment 10: EPA fails to substantiate its selection of the relative risk model to estimate the risk of having cancer as a result of exposure to radon daughter. (I-4(3).45)

Response: EPA disagrees. Adequate support of use of relative risk for estimating lung cancer is readily available. The absolute risk and relative risk models were introduced in BEIR I(18) and used in BEIR III.(3)

As currently defined:(3)

Absolute Risk - "Expression of excess risk due to exposure as the arithmetic difference between the risk among those exposed and that obtaining in the absence of exposure."

Relative Risk - "Expression of risk due to exposure as the ratio of the risk among the exposed to that obtaining in the absence of exposures."

The risk projection models were also defined in reference (3): Absolute Risk Projection Model "According to this model, if a population was irradiated at a particular dose either all at once or over some period, expressions of excess cancer risk in that population would begin at some time after exposure (the latent period) and continue at a rate in excess of the expected rate for an additional period, the 'plateau' or expression period, which may exceed the period of followup. In this model, the absolute risk is defined as the number of excess cancer cases per unit of population per unit of time and per unit of radiation dose, and, though it may depend on age at exposure, it does not otherwise depend on age at observation for risk."

Relative Risk Projection Model - "In the second model adopted in BEIR I, the so called relative-risk model, the excess cancer for the interval after the latent period was expressed as a multiple of the natural age-specific cancer risk for that population. The chief difference between the two models is that the relative-risk model took account of the differing susceptibility to cancer related to age at observation for risk."

"If the relative-risk model applies, then the age of the exposed groups, both at the time of exposure and as they move through life, becomes very important. There is now considerable evidence in nearly all the adult human populations studied that persons irradiated at higher ages have in general a greater excess risk of cancer than those irradiated at lower ages, or at least they develop cancer sooner. Furthermore, if they are irradiated at a particular age, the excess risk tends to rise pari passu with the risk of the population at large. In other words, the relative-risk model with respect to cancer susceptibility at least as a function of age, evidently applies to some kinds of cancer that have been observed to result from radiation exposure."

The 1980 BEIR Committee also made some caveats regarding the certainty of our knowledge on the two models. However, they later commented (p. 137), "If risks are given in absolute form - i.e., number of cancers induced per unit of population and per unit of radiation exposure - then a single value independent of age may be inappropriate." For lung cancer the 1980 BEIR committee used no single value but a risk coefficient which varied with age.

Since BEIR III provided an extensive analysis of lung cancer induction due to radon progeny, the projection model they used - age specific absolute risk was compared to the relative risk model used by EPA. As mentioned in the DEIS there was very little numerical difference. We have concluded that our relative-risk model and the BEIR 1980 age-dependent absolute risk model are essentially equivalent.

The commenter's consultant, [Dr. Hamilton (17-18)], found only that the study by Dr. C. Land and J. Norman(21) supported a relative risk model for lung cancer. He felt the Smith and Doll paper(22) involved proportionality among sites and in general did not support relative risk. However, on page 216 of his sited reference Smith said, "The statement I made was based on our finding that the risk of a radiation-induced cancer seems to increase with age at exposure in direct proportion to the expected number of deaths from cancer that would be suffered by persons first treated at a particular age. This suggests to us the radiation is interacting with whatever other factors are inducing cancer." This statement is comparable to the definition of relative-risk given by BEIR III. Since BEIR III (p. 312-313) reported a significant increase in lung cancer in the population studied by Smith and Doll, it is reasonable to consider lung cancer one of the cancers described by Smith's statement.

Dr. Hamilton cited the Kato and Schull report (H. Kato and W. J. Schull, Radiation Res., 90: 395-432, 1982) and concluded that an absolute risk or, if external exposure and radon daughter exposure are equivalent, a lower relative risk than EPA's should be used. Unfortunately, the dose estimates in Japan are unreliable and no comparisons should be made until after the dosimetry review now ongoing is complete. EPA reference was to Kato and Schull's conclusion (p. 408). "Thus, though in the recent BEIR report two different models (relative risk and absolute risk models) have been used for projection of risk beyond the period of observation, the present data support the relative risk model projection more strongly. The excess deaths from cancers other than leukemia increase with age at death for the same age cohort in proportion to the age-specific death rate from cancers in the population of all Japan and do not show a constant excess value by age at death for the same age cohort."

The report by Shi-quan and Xiao-ou(23) shows that even at ages less than 10, exposure to radon does not lead to lung cancer before the age at which "spontaneous" lung cancer develops. This pattern as noted in the DEIS is consistent only with relative risk and age specific absolute risk lung cancer induction models. It is not consistent with simple absolute risk and thus it does lend additional support to EPA's use of the relative risk model.

Most recently Prentice, et al. (R.L. Prentice, et al., JNCI, 70:611-622, 1983) and Whittemore and McMillan (A.S. Whittemore and A. McMillan, Technical Report No.68, prepared for SIMS, Stanford University, California, 1983) have used the relative risk projection model on estimating radon related lung cancer hazards as have Drs. Thomas and McNeill(2) in a detailed analysis of radon-daughter related lung cancer.

Comment 11: EPA's use of the linear non-threshold model for radium is contrary to its stated policy of using "the best available detailed scientific knowledge in estimating health impact." Both BEIR III and UNSCEAR have concluded that the dose-response for radium includes a dose-squared term. If a radium standard is to be set, there is no reason to set it any lower than 30 pCi/liter. (I-6(3).65, I-6(3).6)

Response: Although a dose squared term is included in the BEIR III risk coefficient for bone cancer, it predominates over the linear term only at doses exceeding 1000 rad, compare the coefficients in Table A-27 in Na80. For the range of doses and dose rates of interest here, i.e., much smaller than one rad, the dose squared term is negligible.

Comment 12: EPA used a 70-year effective exposure time, without subtracting the latency period, resulting in an overestimate by a factor of between 1.2 and 1.6. (I-25.11)

Response: EPA uses a life table approach to calculate stochastic risk. The latency period, i.e., the minimum induction period, and the risk plateaus, are an integral part of these calculations. Latency is accounted for on an annual basis for each successive year of life. The methodology is described in Appendix C and plateau values are given in Table C-1.

Comment 13: EPA based its projected health risks on a person living in the same house for 70 years, resulting in a factor of five overestimate in risk. (I-25.13)

Response: See the response to Comment 18, Section A.2.1.

Comment 14: EPA's risk model for radon decay product levels in houses overestimates the degree of radon daughter equilibrium. This results in estimates that are excessive and belied by the actual data, including actual EPA data. (I-6(3).34, F-3(2).10, P-9(3).11, I-24.3, I-25.12, I-4(3).44, I-4(3).29)

Response: Several commenters have questioned the use of an equilibrium fraction of 70 percent for radon daughters in structures. Observations of this fraction are highly valuable. The degree of equilibrium depends on many variables such as ventilation and plateout but is also strongly dependent on the degree of equilibrium which exists in the incoming air. For example, a calculation using a ventilation rate of 1 h^{-1} and an effective plate out rate of 1 h^{-1} yields an equilibrium fraction of 0.36 for an initial equilibrium fraction of 0 and 0.68 for an initial equilibrium fraction of 1.0. Since the degree of equilibrium in the air entering structures within areas adjacent to tailings piles would be expected to be low under normal meteorological conditions, EPA has reduced its estimate of the equilibrium fraction by one half for the calculation of risk to maximum exposed individuals. Although some commenters have suggested lower values, these appear to be based primarily on studies of structures in which the radon entered only by diffusion so that the initial equilibrium fraction was zero.

Comment 15: On page 5-4 of the DEIS, it is stated the assumed equilibrium fraction for indoor radon and its decay products is 70 percent. Our more extensive measurements indicate that the proposed number is about 30 percent high; the more appropriate range is 50 to 55 percent. (I-16(2).7, I-29.7)

Response: See the response to Comment 14, A.2.1.2.

Comment 16: Cigarette smoking is the most important factor in determining whether a health effect will result from exposure to radon. EPA's projections incorrectly assume that cigarette smoking will persist over the next several thousand years. (I-15.4, I-15.3)

Response: We agree, however, there are many possible confounding factors, e.g., medical advances, smoking habits, etc., which cannot be accurately projected, particularly over long time spans. In general, attempts to extrapolate even such basic health data as birth and death rates has a greater impact on the magnitude of risk estimates than the cause under investigation. One reason for EPA's use of a "current experience" life table is to avoid making such projections. Although certain unspecifiable confounding factors may be neglected, the stationary population so defined provides meaningful estimates of health effects on a present value basis.

Comment 17. EPA may have overestimated the risk of lung cancer per WLM by a factor of eight. (I-25.10)

Response: EPA disagrees. The commenter cites a radon-daughter lung cancer risk coefficient of 1.2×10^{-4} cases/WLM used by Evans, et al.(11) and Bair, et al.(24) Actually, Bair, et al. used the Evans, et al.; but they stated the upper estimates may be 2 to 3 times different.

There is no way to determine how the Evans et al. estimate was made. The paper goes from selected annual risk coefficients in some miners to a lifetime estimate without indicating latent periods, period of expression, etc. Apparently they assumed a 15 year expression period even though the documented risk is over twice this long. These problems, in addition to other questionable assumptions, cast doubt on the validity of this estimate in comparison to more fully documented estimates for which there is an adequate rationale.

Comment 18: EPA's risk estimates discount advances in medical science; this is confounding. (I-15.5)

Response: See the response to Comment 16.

!*Additional Comments*!

Comment 19: EPA should give greater consideration to the BEIR III report in making quantitative estimates of radiation risk. (F-3(2).2)

Response: As shown by the risk estimates in Chapter 6 of the DEIS, almost all of the estimated risk due to uranium milling operations excess is lung cancer due to inhalation of radon progeny. Although EPA has used its own relative risk model to estimate this risk, we have compared our results for lifetime exposure to lifetable calculations using the age dependent absolute risk coefficient for radon given in the 1980 BEIR report.(3) The estimated risks are nearly identical, 860 cases per 10^6 person WLM vis a vis 850 cases per 10^6 person WLM.(4) The difference in these two risk estimates is much smaller than the uncertainty in either, see the response to Comment 2, A.2.1.

Comment 20: The underlying bases for the calculations of health effects are not fully addressed in the DEIS. (P-33.3)

Response: The EPA risk assessment procedure is complex and presentation of the complete methodology in each standard or regulation would be overly prolix. We agree that some persons may require more complete technical information than provided in the DEIS. The material cited in the references to Chapters 5 and 6 of the DEIS provide more complete descriptions of the methodology underlying the analysis. The references cited, if not available through EPA or the sponsoring agency, may be obtained through the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161. See the response to Comment 10, A.2.1.

Comment 21: We urge you to take into account the health effects that may arise from mining in Virginia, an area of higher population density and net precipitation. (P-51.1, P-52.1, P-53.1, P-54.1, P-55.1, S-7.1, P-56.1, P-57.1, P-58.1, P-59.1, P-61.2, P-63.1, P-64.1)

Response: There is currently no milling of uranium ore in Virginia. However, radon emissions would be lower from any tailings that may be produced in Virginia than from the tailings modeled in the FEIS, because Virginia is an area of net precipitation and wet tailings emit one third or less radon than do dry tailings.

A.2.2 Nonradiological Health Risk Assessment

Comment 1: EPA does not provide risk estimates for potential exposure to nonradioactive toxic compounds and heavy metals associated with uranium deposits, such as cyanide, arsenic, cadmium, lead, mercury, selenium and molybdenum. (P-1(H2-2).4, P-1(2).22)

Response: Estimates of levels that might produce chronic toxicity were given in the DEIS pages C-21 to C-23, and readers were referred to the final EIS for inactive sites (FEIS-I, Volumes I and II) for a more extensive discussion of the question.

As pointed out in the DEIS pages 5-3, 5-17, and 6-12, there is insufficient information for risk modeling for toxic materials. The problem is quite site-specific.

Comment 2: Would residues of solvents used in the extraction process be expected to be present in mill tailings and, if so, are such residues leachable? What hazards do they pose to the integrity of a disposal system and to human health? (S-5.6)

Response: The last two paragraphs on page C-21 of the DEIS summarize what little was known about these organic chemicals. Basically, they are valuable, so they are recycled and only fugitive emissions are expected.

In any case, application of existing SWDA regulations at 40 CFR 264.92 (and related section) as proposed in the standards would require identification and control of those hazardous chemicals in Appendix VIII of Part 261 of the SWDA regulations. This should control currently recognized hazardous solvents, if present. This was discussed on p. 19594 of the Supplementary Information. (Fed. Reg., 48: 19584-19603, April 29, 1983)

REFERENCES

(1) Sullivan R.E., et al., "Estimates of Health Risk from Exposure to Radioactive Pollutants," ORNL/TM-7745, Oak Ridge National Laboratory, Oak Ridge, Tennessee, 1981.

(2) Thomas D.C. and McNeill K.G., "Risk Estimates for the Health Effects of Alpha Radiation," Prepared for the Atomic Energy Control Board, Ottawa, Canada, INFO-0081, September 1982.

(3) National Academy of Sciences, "The Effects on Population of Exposure to Low Levels of Ionizing Radiation," Committee on the Biological Effects of Ionizing Radiations, NAS, National Academy Press, Washington, D.C., 1980.

(4) Radiation Policy Council, "Report of the Task Force on Radon in Structures," RPC-80-002, U.S. Radiation Policy Council, Washington, 1980.

(5) United Nations Scientific Committee on the Effects of Atomic Radiation, "Source and Effects of Ionizing Radiation, Report to the General Assembly," U.N. Publication E.77.IX.1, United Nations, N.Y., 1977.

(6) United Nations Scientific Committee on the Effects of Atomic Radiation, "Ionizing Radiation: Sources and Biological Effects, 1982 Report to the General Assembly," U.N. Publication E.82.IX.8, United Nations, New York, 1982.

(7) Environmental Protection Agency, "Indoor Radiation Exposure Due to Radium-226 in Florida Phosphate Lands," EOA 520/4-78-013, Office of Radiation Programs, USEPA, Washington, D.C., July 1979.

(8) Nuclear Regulatory Commission, "Final Generic Environmental Impact Statement on Uranium Milling," NUREG-0706, Office of Nuclear Material Safety and Safeguards, USNRC, Washington, D.C., 1980.

(9) International Commission on Radiological Protection "ICRP Publication 26," Pergamon Press, N.Y., 1977.

(10) Nuclear Regulatory Commission, "Radon Releases from Uranium Mining and Milling and Their Calculated Health Effects," NUREG-0757, Office of Nuclear Material and Safety and Safeguards, USNRC, Washington, D.C., 1981.

(11) Evans R.D., et al., "Estimate of Risk from Environmental Exposure to Radon-222 and Its Decay Products," Nature, 290:98-100, 1981.

(12) Hewitt D., "Biostatistical Studies on Canadian Uranium Miners," pp. 264-287 in Conference Workshop on Lung Cancer Epidemiology and Industrial Applications of Sputum Cytology, Colorado School of Mines Press, Golden, 1979.

(13) Chovil A., "The Epidemiology of Primary Lung Cancer in Uranium Miners in Ontario." J. Occup. Med., 23:417-421, 1981.

(14) Ministry of the Attorney General, "Report of the Royal Commission on the Health and Safety of Workers in Mines." Province of Ontario, Toronto, 1976.

(15) International Commission on Radiological Protection, "ICRP Publication 32, Limits for Inhalation of Radon Daughters by Workers." Pergamon Press, N.Y., 1981.

(16) Archer V.E., "Factors in Exposure Response Relationships of Radon Daughter Injury," pp. 324-367 in Conference/Workshop on Lung Cancer Epidemiology and Industrial Applications of Sputum Cytology, Colorado, School of Mines Press, Golden, 1979.

(17) Wakabayashi, T., et al., Studies of the Morality of A-Bomb Survivors, Report 7, Part III. Incidence of Cancer in 1959-1978, Based on the Tumor Registry, Nagasaki. Radiation Research; 93:112-146, 1983.

(18) National Academy of Sciences, The Effects on Populations of Exposure to Low Levels of Ionizing Radiation, Report of the Advisory Committee on the Biological Effects of Ionizing Radiation, PB-239 735/AS, NAS, National Technical Information Service, Springfield, Virginia, 1972.

(19) Ellett W.H. and Nelson N.S., "Environmental Hazards from Radon Daughter Radiation," pp. 114-148 in Conference/Workshop on Lung Cancer Epidemiology and Industrial Applications of Sputum Cytology. Colorado School of Mines Press, Golden, 1979.

(20) Meyers D.K. and Stewart C.G., "Some Health Aspects of Canadian Uranium Mining," pp. 368-397 in: Conference/Workshop on Lung Cancer Epidemiology and Industrial Applications of Sputum Cytology, Colorado School of Mines Press, Golden, 1979.

(21) Land C.E. and Norman J.E., "Latent Periods of Radiogenic Cancers Occurring Among Japanese A-Bomb Survivors," pp. 29-47 in: Late Biological Effects of Ionizing Radiation, Volume I, IAEA, Vienna, 1978.

(22) Smith P.G. and Doll R., "Age- and Time-Dependent Changes in the Rates of Radiation-Induced Cancers in Patients with Ankylosing Spondylitis Following a Single Course of X-ray Treatment," pp. 205-218 in Late Biological Effects of Ionizing Radiation, Volume I, IAEA, Vienna, 1978.

(23) Shi-quan S. and Xiao-on Y., "Induction-Latent Period and Temporal Aspects of Miner Lung Cancer," unpublished report (in English), 1982.

(24) Bair W.J., et al., Estimates of Potential Health Effects Resulting from Radioactive Materials Contained in Inactive Uranium Mill Tailings Piles, pp. 207-219 in: Management of Commingled Uranium Mill Tailings, H.A.S.C. No. 97-55, House Armed Services Committee Hearings, U.S. Government Printing Office, Washington, 1982.

(25) Bloomster C.H., et al., "Estimated Population Near Uranium Tailings Ponds," Report by Battelle Pacific Northwest Laboratory, to be published, June 1983.

A.3.0 RATIONALE FOR STANDARDS

A.3.1 Basis for Standards

!*The Standards Are Inadequately Supported*!

Comment 1: Analysis of the information contained in the RIA reveals that EPA: (1) used faulty reasoning, out-of-date industry data, and unlikely assumptions about the likely effects of its proposed standards; (2) failed to justify the stringency of the proposed standards; (3) neglected to give adequate consideration to less costly alternatives and the benefits that would result therefrom; (4) failed to satisfy its statutory obligation to propose standards with a reasonable cost/benefit relationship; and (5) acted arbitrarily and capriciously in proposing these standards. (I-4(3).107)

Response: EPA has responded elsewhere in this document, particularly in Section A.3.3, to specific assertions and recommendations the commenter supplied in support of the views summarized above.

Comment 2: The bases for EPA's proposed standards are in most cases impossible to discern. Information, including the technical data apparently relied upon, is presented in a confusing manner and the Agency discloses no logical relationship between its assumptions, findings, and conclusions. These deficiencies raise substantial questions as to whether EPA has permitted informed, meaningful comment in this rulemaking proceeding or provided an adequate record for later judicial review. (I-4(3).6)

Response: EPA responds elsewhere throughout this document to the specific assertions and recommendations the commenter supplied in support of the views summarized above. We agree with the commenter that EPA should engage in and provide an adequate record of reasoned rulemaking. EPA believes it has done so.

Comment 3: Inadequate justification exists for EPA to promulgate these standards as proposed. EPA arbitrarily establishes a standard and retrofits both health effects and economic arguments to justify the standard. Any responsible scientific arguments contrary to EPA's standards development are summarily categorized as unfounded, incorrect, or not in the best interests of public health and safety and are ignored. Therefore, the proposed standards should be remanded for reconsideration and redevelopment. (I-1(2).4, I-1(2).1)

Response: EPA disagrees. The standards are supported by lengthy and detailed analysis, presented in the EIS and RIA. Scientific arguments have been analyzed and critically evaluated, not ignored (see, for example, Section 2, above).

Comment 4: The proposed regulations are not based on supportable scientific data and are arbitrary. (I-5(2).4, I-20.1)

Response: In Section 2, above, and elsewhere as appropriate we have responded in detail to specific comments on scientific data and analyses we have used in this rulemaking. We believe our use of available data is consistent with the current state of scientific knowledge and is adequate to support the rulemaking.

Comment 5: Even the most advanced technology used in uranium mining and milling has not come close to protecting the health of the people and the environment. (P-62.1)

Response: EPA believes that technology is available to satisfy these standards, which will adequately protect public and the environment.

!*The Standards Should Be Based on Existing Regulations and Guidance*!

Comment 6: EPA's proposed standards are not in accordance with the generally accepted radiation protection principles of the NCRP and ICRP. EPA's 20 pCi/m^2-sec radon standard was proposed without any discussion of the ICRP 500 mrem recommended standard or the NCRP 500/170 mrem recommended standards and without any showing as to the need to reduce these recommendations. (I-4(3).17, I-4(3).16)

Response: The NCRP and ICRP "recommended standards" are intended as general upper limits for protecting public health without regard to the characteristics of any specific radiation producing activity. It is also a generally accepted radiation protection principle that doses from individual activities be kept as low as is reasonably achievable. Congress directed EPA to set specific standards for tailings. EPA has shown, in the EIS and RIA, that the 20 pCi/m^2-sec limit represents the lowest reasonably achievable long-term emission rate from tailings, which will result in the lowest reasonably achievable health impact on the general public.

Comment 7: EPA should not adopt standards which are inconsistent with the well-founded and workable regulations of the State of New Mexico. (P-28.7)

Response: EPA's analysis in the EIS and RIA shows that standards that are more stringent in some respects than those adopted by New Mexico are reasonable to apply. Furthermore, UMTRCA requires EPA's standards for nonradioactive materials in tailings to be consistent with standards EPA established for hazardous wastes under the Solid Waste Disposal Act, not with New Mexico's standards.

Comment 8: EPA should adopt a radon emission standard under the procedural and substantive mandates of the Clean Air Act. The proposed radon rule is inconsistent with the CAA, in at least four respects

a. The Agency could not lawfully rely on cost consideration as a basis for setting the standard.

b. The CAA requires a standard more protective of the public health.

c. The standard would have to be a performance standard and not simply a design standard.

d. Periodic post-closure measurements of actual emissions would be required to ensure long-term compliance with the standard.

(P-45.11)

Response:

a. EPA considered cost, as UMTRCA, as amended, requires, but it did not rely exclusively on cost as a basis for setting the standard.

b. The Agency believes the disposal standard established in this rule provides protection of public health comparable to that which might be established under the Clean Air Act, for the reasons stated in the Preamble.

c. We believe a performance standard that applies over 1000 years is not feasible.

d. We believe it is not feasible to require post-disposal monitoring for 1000 years, the period over which the emission standard applies. Furthermore, it may take many years for covered tailings to reach a stable long-term condition, particularly with respect to moisture content. Measurement during that transition period would not reliably indicate long term emission rates. We believe thorough pre-disposal analysis that takes adequate account of uncertainties and careful installation of the disposal system are the most reliable and the only practical way to provide reasonable assurance of long-term emission rates.

Comment 9: The 15 mrem referenced in these rules is inconsistent with the 10 mrem proposed limit in the proposed Air Emission rule. (S-3(H2).3)

Response: The commenter appears to be referring to the 25 mrem (not "15 mrem") standard (40 CFR 190) for uranium fuel cycle facilities that is referred to in Section 192.32(a) of this rule for tailings, and contrasts it with a proposed 10 mrem standard under the Clean Air Act for certain NRC-licensed and DOE-operated facilities. The reference to 40 CFR 190 merely reaffirms that it still applies under this new rulemaking. The 10 mrem standard is a proposal for diverse facilities, most of which are very different from uranium mills. We understand that there is a potential for confusion whenever several different standards are issued in similar forms. Because they apply to different kinds of operations, however, being numerically different is not the same as being inconsistent.

!*The Standard Should Be Based on Comparison with Other Risks*!

Comment 10: One of the inherent problems in judging the significance of a health risk - in this case a mortality risk - is the absence of agreement on the definition of "significant." We think that the key to evaluating the significance of risks in this context is to avoid judging them in a vacuum. In the present proposal, EPA has evaluated the risks posed by several alternative disposal standards against each other, but not against the considerable array of other risks associated with activities of contemporary life. EPA has failed to demonstrate the significance of the radiation risks from milling because it has not performed a comparative risk assessment. Had EPA provided such a comparison the risk to the general population would be seen as vanishingly small. (I-10(2).4, I-6(3).29, I-6(4).7)

Response: Several commenters argued that EPA has not demonstrated that the risks associated with radon emissions from tailings are significant, and observed that much of the health impact attributed to tailings accrues to very large numbers of people at very low levels of individual risk. They suggested that the proper test of significance is to compare such risks with common hazards, such as the risk from the natural background radiation. For example, they would compare the 6 lung cancers per year that EPA estimates (see FEIS) could result from uncontrolled tailings piles after the year 2000 with: the 21,000 such cancers a commenter estimated as caused annually by background radiation; deaths from motor vehicle accidents (50,000 per year) and home accidents (25,000); tornadoes (130); etc. Based on such comparisons, these commenters concluded that the risks from radon emitted from tailings are not significant, and that EPA's standard should not limit such emissions.

EPA believes these comparisons are misdirected and do not address a central purpose of the legislation that requires this rulemaking, which is to "...make every reasonable effort to...prevent or minimize radon diffusion into the environment...from...tailings." EPA recognizes that radiation background and other common hazards cause far greater total annual harm than anyone would reasonably estimate might occur from uncontrolled radon emissions from tailings. However, these other risks are not the subject of this rulemaking. Comparisons of the type suggested may be useful for setting priorities for efforts to reduce the variety of hazards to public health (to the extent that they are avoidable), but they are not useful for deciding the appropriate level of control for a specific source of hazard. That decision must be based upon the specifics peculiar to the hazard under consideration. The existence of other hazards does not, absent Congressional direction, justify EPA's delaying these standards until all other controllable hazards are addressed, or justify EPA's ignoring Congress' will that standards be set.

The fact that the health impact of tailings is in large part attributable to small radiation doses delivered to large numbers of people over long periods of time was recognized when UMTRCA was enacted. The then Chairman of the NRC testified as follows: "The health effects of this radon production are tiny as applied to any one generation, but the sum of these exposures can be made large by counting far into the future, large enough in fact to be the dominant radiation exposure from the nuclear fuel cycle. Whether it is meaningful to attach signficance to raidation exposures thousands of years in the future, or conversely, whether it is justifiable to ignore them, are questions without easy answers. The most satisfactory approach is to require every reasonable effort to dispose of tailings in a way that minimizes radon diffusion into the atmosphere." (H.R. Rep. No. 1480, 95th Cong., 2nd Sess., Pt. II, p.25.) We have concluded that maximum individual lifetime risk (estimated as 2 in 100) and the long-term cumulative impact on populations (potentially many tens of thousands of deaths over the long term) due to radon emissions from tailings are clearly signficant enough to justify controls. As discussed in the FEIS, RIA, and Preamble, our analysis shows that tailings can, at a reasonable cost, be disposed of in a manner that provides, among other benefits, greatly reduced radon emissions.

Comment 11: Risk of radon from tailings is not placed in context with other hazards, other sources of radon, or other natural background radiation. (F-3(2).3, I-4(3).29, I-6(3).75, I-6(4).7, P-9(H1).8, I-13(2).1)

Response: We have noted (Preamble) that EPA estimates six lung cancers per year could result from uncontrolled tailings piles after the year 2000 and that commenters established: 21,000 such cancers might be caused annually by background radiation; 50,000 deaths occur annually from automobile and 25,000 from home accidents; 130 annual deaths occur from tornadoes, etc. As we indicate in the response to Comment 10, above, however, we don't believe such comparisons are relevant to this rulemaking.

Comment 12: Congress specifically provided in amendments to the Mill Tailings Act that EPA and NRC must consider the significance of risk posed by mill tailings. EPA should perform a comparative risk assessment, placing the risks it has identified in context with risks one faces everyday. Comparison of the risks EPA has identified from radon from uranium mill tailing with natural background radiation, and risks people face in every day life shows that the risks from tailings radon are insignificant. (I-4(3).24, I-4(2).23, I-6(3).29, I-6(4).7, I-6(H2).28)

Response: EPA followed all legislative directives in establishing these standards. Congress directed EPA to consider "all relevant factors," which we have done.

!The Radon Standards Should Be Based on Comparison with Background Radiation!

Comment 13: EPA has not demonstrated that radon from tailings constitutes a significant risk because it has not evaluated the significance of the risks identified, has not provided any criteria for evaluating risk, or presented any evidence that it has conformed with any accepted risk assessment procedures. We suggest EPA provide a comparison of the risk it has identified with risks from natural background as this is a widely accepted method. (I-4(3).22)

Response: See the response to Comment 10, A.3.1. EPA has estimated maximum individual lifetime risk from uncontrolled tailings as 2 in 100 and the long-term cumulative impact on populations as potentially tens of thousands of deaths. We believe it is self evident that these are significant risks that warrant consideration of appropriate controls.

Comment 14: EPA should consider background radiation levels and their variability in assessing exposure due to tailings radon. (F-3(2).4, I-6(H2).4, I-24.4)

Response: Background levels and their variability must be accounted for when interpreting measurements to assess how much a specific source is contributing to the measured values. When tailings are used in and around buildings, the resulting indoor radon levels are often many times the values one would expect from "background." When measured values are not that high, it is indeed difficult to estimate the contribution of the tailings to the total. Similarly, when outdoor radon levels are measured farther than one-fourth to one-half mile or so from tailings piles the results are often within the normal range of variation of background. Thus, in assessing risk from radon emitted by tailings piles, we use well-established atmospheric transport models. However, risk assessment is only one aspect of standards. The reasonableness of risk reduction is another. If we find it technically practical to reduce risk for costs that are in reasonable relation to the benefits, it is immaterial whether the risks from that source for some population are measurably discernible relative to the background. See the response to Comment 16, A.3.1.

Comment 15: In comparison to the risks associated with exposure to natural background, and given the remoteness of many sites, control of most of the radon exposure due to tailings would generally present a negligible risk to the U.S. population. (I-4(H2).7)

Response: See the response to Comment 13, A.3.1.
If all sites were locally unpopulated and the cumulative effect of exposure on large, distant populations were very small, then the radon exposure would be negligible. The facts are otherwise, however. People do live near tailings and more may live there in the future. The cumulative long-term effects of exposures to radon from tailings may be tens of thousands of deaths.

Comment 16: EPA's attempt to establish radiation protection standards within the variations of natural background is contrary to long-standing radiation protection principles. (I-4(3).19)

Response: The "long-standing" principles the commenter mentioned are the general upper-limit of dose allowed to a member of the public (500 mrem/yr) and the obligation to keep actual radiation exposures as far below this upper limit as is reasonably achievable. We fail to understand why it is inconsistent with these principles to set standards for a specific category of activities that will keep exposures from that category as low as is reasonable to achieve. Indeed, nuclear fuel cycle facilities in the U.S. and Europe have for years operated under categorical limits that are small fractions of 500 mrem/yr.

!The Standards Should Be Based on Reasonable Control of Significant Risks!

Comment 17: EPA's proposed standards are faulty since they were developed under the false premise that Congress (through UMTRCA) directed EPA to minimize or eliminate radon emanation from tailings piles regardless of risk or cost. In fact, UMTRCA requires both EPA and NRC to identify significant environmental hazards (as determined by comparative risk assessment) and to take reasonable measures to control them. (I-6(3).1, I-6(3).14, I-6(H2).28, I-4(3).3, I-4(H2)12)

Response: UMTRCA clearly required EPA to take reasonable measures to minimize or eliminate radon emissions, and to consider cost and risk in doing so. EPA has complied with UMTRCA. We have not found, however, that UMTRCA requires EPA to determine significant risks by comparative risk analysis.

Comment 18: EPA's failure to provide a supportable rationale for a conclusion that the aspects of tailings management that it seeks to regulate pose a significant risk, and its neglect of cost/benefits leads it to propose controls that are not reasonably required by the abstract risks EPA has identified. This is unlawful. (I-6(3).5, I-6(3).31, I-6(4).7, I-30.1)

Response: Regarding "significant risk," see the Preamble and the response to Comment 17, above. Regarding "cost/benefit," EPA has evaluated costs and benefits, as described in the Preamble, RIA, and FEIS. Further, determining that a risk is significant enough that regulation is warranted is not necessarily the same as determining that the hazard has in fact been realized in actual harm, that the risk compares unfavorably with risks associated with background levels, workplace hazards, natural events, etc., or determining that whatever risks to health exist may be discounted -- and regulation withheld -- based on expectation which, if realized, would limit the actual occurrence of the anticipated hazard. Whether or not such bases of evaluation of risk are reasonable is not the issue. The issue is whether public health and environmental protection may also be based on a rational expectation of nonnegligible harm. Nothing in the relevant statute suggests that Congress intended EPA to abandon that traditional regulatory approach to protecting health and environment or provides EPA with any basis for adopting another basis for evaluating "significance" of risks. To the contrary, Congress indicated its "displeasure" with EPA's delay to set standards, as to which Congress emphasized that protection considerations must be "paramount."

Such expressions of intent are not consistent with a Congressional intention that EPA defer - on some basis or other - regulation of this component of manmade and other risks comprising our (controllable and uncontrollable) risk environment. Nor does the fact that deaths from other causes statistically outnumber deaths attributable to radon (epidemiologically speaking) diminish the significance of the latter. Suggestions that societal concern to address these risks is misguided should therefore be addressed to Congress, not the EPA.

Comment 19: EPA's active site standards must be based on a finding of significant risk to public health and safety. Court decisions that support the significant risk doctrine include:

a. Industrial Union Department, AFL-CIO v. American Petroleum Institute, 448 U.S. 607 (1980) (Benzene)

b. Pratt & Whitney Aircraft v. Secretary of Labor, 649 F.2d 96, 104 (D.C. Cir. 1981)

c. Ethyl Corporation v. EPA, 541 F.2d 1 (D.C. Cir.), cert. denied, 426 U.S. 941 (1976)

(I-6(3).6)

Response: Comments arguing that decisional law generally requires a threshold finding that a risk is significant misconstrued the cases cited and seem selectively to limit methods for establishing significance to comparative evaluations. While tending to criticize evaluations of risk which cumulated nationwide, intergenerational and/or lifetime exposures, such commentors pointed to large-scale national risks not addressed by Congress in UMTRCA as a basis for minimizing the level of protection afforded by the standard.

In Industrial Union Dept. AFL-CIO v. API, 448 U.S. 607 (1980) ("Benzene Case") the court held that OSHA must make a "threshold finding that a place of employment is unsafe in the sense that the significant risks are present and can be eliminated or lessened by a change in practices" at 642. The Benzene decision is clearly the product of the terms of the OSHA statute and, in the absence of comparable provisions in UMTRCA, is not directly relevant to UMTRCA standards. The Benzene court relied heavily, for instance, on the terms of Section 3(8) empowering OSHA to promulgate standards "reasonably necessary and appropriate to provide safe places of employment." Id. Pratt and Whitney Aircraft v. Secretary of Labor, 649 F. 96, 104 (D.C Cir. 1981) follows the Benzene case in interpreting the requirements of OSHA. Independently, Ethyl Corp. v. EPA 541, F. 2d 1 (DC Cir. 1976) cert.den. 426

U.S. 941 (1976) interprets a Clean Air Act standard ("will endanger") as requiring not that actual harm be demonstrated but only that EPA establish a "significant risk of harm."

Even if the Benzene or Ethyl decisions might be generalized to all health regulation or even if a finding of significant risk were a necessary, if implied, predicate to such regulation as a matter of administrative law, EPA has found that risk sufficient to warrant regulatory concern exists. It is true, but irrelevant, that it has not made such a finding in terms of comparison to nonstatutory risks. EPA's finding is instead properly based on protection considerations of the sort identified in the statute. It has found, for instance, that risk of radon exposure from tailings piles to populations and individuals is unacceptably high, that risk of contamination of groundwater to levels exceeding appropriate standards is high, that the possibility of such risks to continue is significant, and that methods are probably available to reduce such risks. Comments that these risks are overstated and negligible are addressed elsewhere.

Commenters argued that UMTRCA requires EPA to evaluate significance of risk when selecting the standard as well so that the increments of risk reduction achieved are themselves "significant"; see, e.g., Docket item IV-D-87, p.7. No statutory authority for this comment is provided. The comment is based instead on the assertion that "this will assure" EPA compliance with its responsibility to regulate only significant risk. The comment assumes, however, that the significance of a risk is to be determined exclusively by the "burdensomeness" of the control measure rather than by the degree of hazard to health or environment which remains after control. The basis for such an assumption is far from clear.

Comment 20: We believe that tailings should be stabilized and effectively controlled and that they should not be allowed to erode or disperse, to be misused, or to contaminate groundwater. After the development of appropriate stabilization criteria, EPA should determine whether any additional isolation might be justified for the reduction of individual or collective radiation doses. (P-9(3).9, P-9(H1).11)

Response: EPA discussed at length in the Preamble why a specific requirement to reduce radon emission is needed and justified. Briefly, it assures that individual risk will be held to reasonable levels and that cumulative health effects from radon emissions will be minimized as much as is practical in view of technical uncertainties associated with an undemonstrated technology. Because we are not authorized to specify detailed disposal techniques, stabilization criteria alone would not assure the same degree of radon emission reduction.

Comment 21: EPA is obligated to accept the best available scientific opinion that has been offered on the subject of risk assessment. We feel the most authoritative opinion belongs to that of the NCRP, and the most comprehensive scientific evidence was presented by the American Mining Congress. We urge the EPA to embody the recommendations and proposals of NCRP and AMC into its regulations. (I-3(2).3)

Response: EPA believes it is obligated to fully consider all scientific work that is relevant to its standards. This is clearly necessary when "authoritative opinions" do not coincide, as is the case for estimating risks associated with radon from tailings. In Section 2 we have responded in detail to comments by NCRP, AMC, and others on scientific aspects of our rulemaking. Our conclusions are generally in better agreement with recommendations of the National Academy of Sciences and the results of a recent comprehensive Canadian study than with the recommendations of NCRP and AMC.

!Inappropriate Bases for the Standards!

Comment 22: The scientific community has repeatedly warned against using the linear nonthreshold theory (and other risk assessment procedures) as a substitute for judgment. Instead of using risk estimates as an aid to reasoned decisionmaking, EPA apparently treats them as actual risks and then states without analysis that they are significant. (I-4(3).20)

Response: The citation the commentor(1) provides does not necessarily reflect current scientific thinking. In 1977, the ICRP concluded, "one such basic assumption underlying the Commission's recommendations is that, regarding stochastic effects, there is, within the range of exposure conditions usually encountered in radiation work, a linear relationship without threshold between dose and the probability of an effect."(2) They further concluded, "These risk factors are intended to be realistic estimates of the effects of irradiations at low annual dose-equivalents (up to the Commission's recommended dose-equivalent limits). ICRP, thus, recommends linear nonthreshold risk coefficients, similar to EPA's, for annual exposures of less than 5 rem.

The United Nations Scientific Committee on the Effects of Atomic Radiation States: "For another class of effects there seems to be no evidence of a threshold dose and no relationship between dose and clinical severity, such as cancer induction. These effects have been called 'stochastic' by the ICRP [12]. At the present state of knowledge a reasonable presumption is that increased exposure to radiation carries an increased probability of subsequent 'stochastic' health effects. Therefore, for an individual, the level of exposure can give an indication of the presumed probability of occurrence of a stochastic health effect. Such indication may be found by consulting the appropriate dose-response relationship forthe health effect being considered."(3)

It would appear from the contemporary scientific literature that the approach used by EPA is not only reasonable but realistic. Although it is recognized that for low LET radiations, e.g., x-rays, the linear nonthreshold model may give an upper limit of risk(2, 4) the linear nonthreshold model may lead to underestimates of risk for high-LET radiation.(4) It certainly is not very conservative for high LET radiation.

The comment does not appear to represent the views of the entire scientific community. As we noted, for example, the BEIR III report of the National Academy of Sciences cautioned that the linear hypothesis for high LET radiations (such as radon decay products) may underestimate the risk. EPA believes its risk estimates are realistic and consistent with the weight of scientific evidence.

Comment 23: EPA's generally applicable radiation protection standards apparently were based on the ALARA concept. As NCRP's representative testified in a similar context, EPA's standards leave "no room for further ALARA procedures" on a site-specific basis. (I-4(3).18)

Response: The NCRP testimony did not provide evidence or analysis for its contention in this regard. In any case, the comment would not invalidate the standards. Indeed, it could be taken as a recognition that the standards are very well matched to the circumstances to which they apply.

Comment 24: EPA's cumulative addition of risks over very long time periods due to the long-term nature of the risk is not a valid way to assess the significance of risk. Risks do not add across generations, thus one generation, or at most 100 years is the appropriate time frame for evaluating significance. (I-4(3).31, I-4(3).32, I-6(3).32)

Response: EPA can hardly ignore the possibility that radon from tailings may produce future adverse health effects. In the absence of specific knowledge of the future, we estimate total impacts by assuming that health effects will continue to accumulate at current estimated rates. There are many reasons why long-term cumulative health effects might be higher or lower than we estimate. People are people, whether they are members of this generation or the next. We have no scientific justification for ignoring deaths that may occur farther in the future than the commenters' suggested cut-off period. Adopting such an arbitrary assumption as the commenters recommend would be contrary to the interest of developing public health protection policies, which is the primary objective of this rulemaking. Therefore, EPA rejects the recommendation.

Comment 25: It is not appropriate to base a standard on the level of voluntary risk that people undertake in their lives all the time, and it is to EPA's credit that EPA does not make such a comparison in its supporting documents. (P-5(H1).18)

Response: No response is required.

Comment 26: It would be unwise to set rules for other states based on New Mexico's regulations. (P-40.2)

Response: EPA is obliged, in any case, to develop its own rulemaking record and justify its conclusions, independently of conclusions any other regulatory entity had previously reached for its own purposes.

Comment 27: EPA's use of "worst case" risk estimates results in standards that are excessively costly. EPA should use the "expected case" as the basis of its standards. (F-5(3).1)

Response: As we indicated in the responses to Comments 23, A.2.1, and 22, A.3.1, our estimates are intended to represent "expected cases."

Comment 28: Application of existing RCRA (SWDA)regulations is inadvisable for technical reasons. The differences in magnitude, physical properties and proximity to population concentrations between mill tailings and regulated hazardous wastes are too significant to allow for the effective application of common standards. (I-30.8)

Response: The fundamental principle that underlies the (SWDA) hazardous waste standards is to protect public health and the environment by preventing hazardous substances from entering the ground. The principal tool for carrying out this requirement is to place the wastes over an impermeable liner. The standards further provide for preventing degradation of groundwater in the event that contaminants do enter the ground. We have applied these standards to the processing of uranium and thorium wastes because our rulemaking record has not established that such differences as the commenter alludes to would justify deviating from UMTRCA's expressed requirement that we be consistent with the SWDA standards.

!The Standards Should Be Cost-effective!

Comment 29: EPA is required to engage in a balancing process to assure that the cost of regulation bears a reasonable relationship to the expected risk reduction benefits. (I-4(3).5)

Response: Nothing in statute "requires" EPA to engage in a balancing process. We have shown, however, that the costs do bear a reasonable relationship to the benefits. The costs, as discussed in the RIA and the Preamble, are quite consistent with lifesaving expenditures that have been made in many other contexts.

Comment 30: We recommend that EPA heeds the advice of the BEIR Committee by balancing the benefits of its proposed standards against the costs, using commensurate units such as dollars. (P-9(3).10)

Response: The comment refers to a report (the "BEIR II" report) prepared under EPA's sponsorship by a committee of the National Academy of Sciences.(5) The authors urged EPA to use benefit/cost analysis, but they noted severe limitations on the possibility of performing such analyses and on its usefulness in decisionmaking. Many of these limitations relate to having uncertain information, particularly regarding future events, and to social or ethical considerations. These limitations result from our inability to quantify costs and benefits in commensurate terms, such as dollars. We believe that the degree to which we have analyzed costs and benefits is consistent with the advice we were offered in this report. The commenter appears to be urging that we rely on cost/benefit analysis to a far greater degree than we believe the authors of the BEIR II report would find justified for this rulemaking.

Comment 31: The judgmental factors used in defining the most cost-effective alternative for reducing the impacts of tailings misuse and disposal should be explicitly stated. (F-3(2).17)

Response: We agree, and have attempted to do so in the EIS, RIA, and the Preamble. Cost-effectiveness is not our only concern, however. Certain aspects of the standard, such as preventing misuse, are very difficult to subject to cost-effectiveness analysis. Our approach to such issues is guided by technical factors, common sense, and Congress' intentions, e.g., that it would not be a good public health policy to rely primarily on institutional controls for long term protection when physical control methods are available and reasonable to apply.

Comment 32: EPA has failed to obtain specific input for its standards from the industry that it is about to regulate. Further, EPA's approach to radiation protection is to select limits based on what the staff believes is barely feasible economically which results in arbitrary regulations. (I-6(H2).1, I-11(2).11)

Response: EPA issued an Advance Notice of Proposed Rulemaking in 1979, in which it specifically requested information from the public relevant to this rulemaking. EPA also benefited from the records of extensive industry participation in earlier rulemakings by EPA and NRC on related subjects. Furthermore, the voluminous industry comments on the proposed standards have been carefully considered in formulating final standards. We believe our ample rulemaking record and extensive documentation of our analysis shows that the regulations are not arbitrary, and that the costs bear a reasonable relationship to the benefits.

!*Costs Should Not Determine the Standards*!

Comment 33: We wonder whether the cost/benefit approach used to develop the standards is appropriate in setting public health standards. (P-35.5)

Response: We don't believe the approach we used can be fully described as a cost/benefit approach because of limitations in quantifying costs and benefits and the need to satisfy legal requirements that may not strictly be subject to cost/benefit considerations. To the degree that we were able to and where it was relevant to the rulemaking, we identified and compared the costs and benefits of alternative standards as completely as we could. Our choices of standards, however, took account of additional factors, such as technical feasibility, maximum risks, and legal requirements.

Comment 34: EPA's primary objective should be to protect public health, welfare, and safety of the environment; short-term economic costs for something that is going to be around for hundreds of thousands of years should be secondary. (P-14(H2).1, P-1(2).36)

Response: EPA agrees.

Comment 35: EPA should establish the objective in its benefits analysis of reducing radon-induced premature deaths from uranium mill tailings to zero. (P-33.15)

Response: EPA believes that doing so would be arbitrary and unrealistic for carcinogens such as radon decay products, which we presume have no threshold for their potential to cause cancer. We attempt instead to reduce residual risks to the lowest reasonably achievable levels, considering all relevant factors consistent with our legislative authority.

!*Suggested Bases for Establishing the Standards*!

Comment 36: In establishing standards for mill tailings, EPA should be guided by the principle of justification, namely for every radiation exposure, there should be a concrete benefit resulting from the exposure. (P-22(H2).6)

Response: By definition, there is never a benefit associated with exposure to waste products. Rather, the waste must be considered as resulting from some useful process, in this case primarily production of fuel for electrical energy generation. Because the fuel has no other major use, all the detriments of the entire fuel cycle need to be justified by the benefits of the electrical production, and this decision is made in licensing nuclear power plants. Our standards for tailings limit the portion of risk that is derived from wastes at uranium mills.

Comment 37: EPA must:

a. Base its standards on a finding of significant risk to public health and safety.

b. Assure that the cost of regulation bear a reasonable relationship to the expected benefits (reduction of significant risks).

c. Analyze and consider whether reasonable alternatives to the proposed regulations might achieve a better balance between costs and benefits.

d. Engage in reasoned decisionmaking by stating its assumptions, giving the reasons for its rejection of alternatives, and clearly setting forth the rationale for its proposed regulations.

e. Promulgate only general environmental standards which do not preempt NRC's authority to establish engineering, design and operational standards.

Response: See responses to other comments regarding significant risks, and the Preamble. EPA believes that the risks to health of existing and future generations and of environmental contamination are sufficient to warrant regulatory concern. EPA considers that the cost of regulations is reasonable in relation to the benefit achieved and that it has selected the levels of control that are the most effective to satisfy the goals it has identified. The rationale for the standards are set forth in the preamble. The standards leave the NRC due scope for its implementing responsibilities.

Comment 40: The proper basis of EPA's standard should be the prevention of misuse, erosion, dispersion, and groundwater protection; not radon control. Actual health effects are the proper basis of the standard. If this were adopted, controls at specific sites could well differ. (P-9(H1).11, I-6(3).26, P-9(H1).2, P-9(H1).14)

Response: EPA is charged with issuing generally applicable, not site specific standards. We see no reason to preclude controlling radon emissions as part of an overall strategy for controlling tailings. Our analysis indicates that radon control is needed for adequate public health protection and is practical.

Comment 41: EPA's RIA must compare the risks from the problem with the risks entailed in implementing a proposed solution. For example, remedial action at the Ambrosia Lake pile would result in an estimated 2.3 fatalities and 47 injuries. (I-6(3).33)

Response: The RIA presents a cost-effectiveness analysis that indicates the relative effectiveness of adding increasingly more restrictive levels of control. As such, costs and benefits only indirectly related to control methods are not considered. The cost-benefit analysis presented in the DEIS and FEIS accounts for indirect costs and benefits, such as accidental deaths during construction. (See Section 9.4 of the DEIS and the FEIS.)

EPA estimated 0.33 deaths as the number of accidental and radiation-induced deaths which statistically would occur during disposal of a large tailings pile such as the Kerr-McGee pile at Ambrosia Lake. This estimate was for Alternative C3-E (FEIS), the level of protection required by the UMTRCA standards. The number of deaths was then considered in the cost-benefit balancing in Chapter 10 of both DEIS and the FEIS. The commenter's estimate appears high, or to be based on more restrictive control levels than required by the standards.

Comment 42: EPA must, by law, consider the radon risks from nearby uranium mines in assessing the risks from tailings. (P-45.15)

Response: Radon risk from uranium mines is beyond the scope of this rulemaking.

A.3.3 Cost Estimates

!The Costs Will Overwhelm Industry!

Comment 1: Requirements of large amounts of capital and increased operating costs to meet the proposed standards will only further destroy domestic uranium producers, thereby jeopardizing national security requirements of the United States and making our nation's utilities dangerously dependent upon foreign uranium. EPA must abandon its use of inaccurate data and hypothetical cases and utilize site-specific data to properly evaluate the financial and nonfinancial benefit-cost analyses of the proposed standards. (I-1(2).122)

Response: Since UMTRCA requires the EPA standards to be of general application, we decided to assess the costs to the industry on the basis of model facilities rather than perform the analysis for each individual site. However, we used a significant amount of site-specific data to determine the values of the model mill parameters. The size of the tailings impoundments, the ore capacity, and the remaining economic life for each existing mill were estimated. Financial information from individual companies was also used in the economic analysis.

Comment 2: EPA's analysis of the industry's ability to generate capital to comply with its proposed regulations is faulty in two respects. First, the 20 percent cash flow EPA assumes simply does not exist for most of the companies. Second, EPA's assumption that companies will make the needed investments as long as the present value of the future income is positive is not supported by the actual decisionmaking process used by corporations. Corporations select investments based on the relative profitability of all alternative investments. EPA's speculation that producers may be able to pass on price increases of $1.00 or $2.00 per pound ignores the fact that spot market prices are so low that they do not cover "forward costs." The costs of EPA's standards will compel many producers to abandon the market to foreign producers. (I-4(3).109, I-4(3).115, I-4(3).118, I-4(3).119, I-4(3).113, I-4(3).117)

Response: Chapter 5 of the RIA states that mills may close for a variety of reasons, including "a pessimistic long-run outlook on the uranium industry by the parent corporation compared to other business ventures." To analyze the "relative profitability of all alternative investments" for the companies which own uranium mills is clearly beyond the scope of this rulemaking and, frankly, not relevant to developing this standard. As explained in Appendix A of the RIA, the mill closure analysis attempts to estimate how significant an obstacle the tailings disposal costs are to the continued operations of uranium mills. The analysis accomplishes this by estimating the revenues and costs of individual uranium mills and enables a determination to be made solely on the basis of the economics of the mill itself. If a corporation can make more money from another business venture and elects to do so by closing a mill, then we do not believe that this closing should be attributed to the tailings disposal costs. A "no closure" determination by our analysis means that the mill can still be operated profitably even after absorbing the cost of tailings disposal. It does not mean that a company will not choose to exit from the industry. It is possible that a company which does not have these "profitable investment alternatives" could take over the operation of the mill.

The 20 percent cash flow assumption (the RIA also analyzes the effects of a 15 and 25 percent margin) is an average which applies throughout the remaining economic life of a mill. Although this margin may not exist right now, based on historical data in the uranium industry and comparisons in similar industries, we believe that the 15-25 percent cash flow margin assumptions over the remaining life of mills are reasonable. Margins lower than these would probably result in market closures, even before consideration of tailings disposal costs.

Comment 3: EPA's analysis states that the impact of its proposed regulations on uranium imports could not be assessed, but that more utilities have a preference for purchasing from domestic suppliers. This "buy American" assumption is not supported by the surveys done by DOE's Energy Information Administration. (I-4(3).116)

Response: The role of imports in supplying future uranium deliveries and the impact of the EPA standard on imports have been assessed according to DOE/EIA's latest estimates and are reflected in the projections used in the RIA, as explained in Appendix B.

Comment 4: Re: Page 2-24, paragraph 4 - If EPA states the industry is declining, then why add more regulatory expenses on the industry? What is the economic justification? (I-1(2).81)

Response: UMTRCA requires EPA to develop these standards. Congress determined that these standards are needed to protect the public health and the environment. Congress did not say that if the industry is declining, EPA should not develop the standards. In developing these standards, EPA has tried to balance the benefits of the standards with the costs of the standards. We believe that most of these costs would be required anyway in the absence of the standards, due to other regulations such as NRC and State licensing regulations.

Comment 5: Re: Page 2-27, Table 2.16 - If Kerr-McGee is disregarded because capital expenditures are not available, then the cumulative operating income for the companies in the 1978-1980 time period is $78 million. However, during the same time frame, the companies invested $290 million in their operations. These companies are, therefore, operating in a negative cash flow position. Thus, the financial health of the uranium mining industry is worse than estimated by EPA. (I-1(2).85)

Response: The comment states that for the three year period from 1978 to 1980 the companies noted are operating in a negative cash flow position because operating income was $78 million and capital expenditures were $290 million. To properly represent the numbers, the $86 million shown as depreciation and depletion for the same period should be added to the $78 million operating income, for a total of $164 million. However, a more important issue is that the time horizon for the RIA is longer than a three-year period. Thus, what is particularly relevant here are the capital expenditures for 1981 through 1984, as shown in Table 2.18 of the RIA. Planned capital expenditures fall precipitously from their 1980 level, (which was also their peak level) to less than 4 percent of the 1980 level by 1984. Therefore, if one increases the time frame beyond that considered in the comment by just a few years, the cash flow is no longer negative. Lastly, the analysis of impact had to be performed by both looking at the past and into the future. The profitability (model mill closure) analysis was performed using forecast prices and past cash flow levels related to revenues, and the capital availability analysis was performed using the high debt-to-equity ratios currently experienced by the firms.

Comment 6: EPA's standards will permanently lower the profitability of the industry by as much as 12 percent. We doubt any U.S. producers could justify continuing operations or constructing new facilities if EPA's standards are imposed. (I-4(3).112)

Response: EPA believes that the estimates calculated in this comment are erroneous. The spot market price of uranium is not an indicator of revenues as the comment purports. According to the latest DOE/EIA survey, the average delivered uranium price for 1982 was greater than $38 per pound, while the reported average price for 1983 is nearly $36. If the disposal cost increases are related to these price estimates, the percentage reductions in profit are not only less than those presented in the comment, but less than the production cost increases estimated in the RIA, which assumes a base production cost of $30 per pound (see the response to Comment 34-08 for the basis of this assumption). Additionally, the comment states that the percentage reductions in profit, erroneously calculated on basis of an $18 per pound spot market price, would be permanent, or would last as long as the mill is in operation. However, these calculations are already out of date, as the spot market price has risen to $24 per pound as of August 31, 1983.

Comment 7: Liner requirements make no sense if more cost-effective means are available to meet reasonable off-site standards. Requiring liners may shut down what remains of our domestic industry. (P-28.6)

Response: EPA's groundwater protection policy for a new disposal area is to prevent releases of contaminants. EPA knows of no control technology, other than liners, that can achieve this goal. Also no evidence was presented in these proceedings that would indicate other methods are available to achieve this goal. EPA's economic analysis indicates that it is unlikely that any existing mills would close due to the cost of installing liners at new tailings impoundments.

Comment 8: EPA's proposed groundwater standards, if enforced, will force many mills to shut down because of costs for new disposal sites and restoring existing sites. (I-1(2).119, I-1(2).3, I-6(H2).13)

Response: In the RIA, EPA analyzed the economic impacts associated with starting new disposal sites for a variety of control levels. We estimate that it is unlikely that any existing mills will have to shut down as a result of these standards, even if they are required to start new tailings piles.

Comment 9: We recommend that EPA review the costs of meeting the groundwater protection criteria of SWDA, and review its mill closure analysis in light of these costs. (F-5(3).8)

Response: See the responses to Comments 7 and 8, A.3.3. EPA believes its mill closure analysis is adequate.

!*The Costs Will Not Affect the Industry*!

Comment 10: Industry can afford the estimated cost to comply with the proposed regulations. EPA should not help the industry externalize its costs at the expense of public health and the environment. (P-5(H1).15, P-5(H1).7, P-5(3).5, P-5(H1).7)

Response: EPA believes that UMTRCA standards are reasonable in that they provide a high degree of protection of public health and the environment. Additional requirements would provide very little additional protection, and at significantly greater costs. EPA believes additional requirements are unreasonable.

Comment 11: Because the proposed standards are less stringent than current NRC standards, EPA effectively returns regulatory costs to uranium producers. (P-4(H1).3)

Response: EPA's standards (for post-closure radon releases) are established as upper limits for the design of tailings disposal systems. NRC's current (suspended) standards were lower design goals. EPA believes there is little difference in the end result. Both would require a thick, durable cover that would last a long time. EPA's standards are stricter in other respects.

Comment 12: EPA's cash flow analysis in its mill closure analysis fails to account for mill closings which are caused by insufficient market demand for uranium. Given the high levels of predicted inventory, mill closures due to regulatory costs are likely to represent only a small portion of the capacity which should close in light of larger market factors. Given the excess capacity of the industry and EPA's failure to take market factors into account, it is unreasonable to predict that any portion of existing capacity will be closed because of regulatory costs. (P-45.34)

Response: There are several inaccuracies in this comment. The RIA for the proposed standards does account for mill closures due to market conditions, as noted by the entries in the "Premature Closure" column of Tables B.3 and B.4 for the years 1981 through 1984. Contrary to the comment, the closures are explicitly due to the excess inventory condition of the industry, estimated in 1980 as being about four years worth of annual demand for conventionally milled uranium. We assumed that this excess inventory condition would be eliminated by the end of a six-year adjustment period, so that by the beginning of 1987 the inventory level would represent approximately one year's worth of demand. In Tables B.3 and B.4, the inventory estimates for 1987 represent 1.4 (Baseline Demand) and 1.5 (Low Growth Demand) year's worth of demand. We further assumed that there would not be a buildup of excess inventories over the remainder of the projection period and constrained the model so that inventories would not be greater than two years worth of demand, a level which we do not consider to be excessive. At the end of the year 2000 the inventory level represents 1.8 (Baseline Demand) and 2.0 (Low Growth Demand) year's worth of demand. Therefore, the comment is erroneous in stating that the "level of excess inventory is quite high." The comment is correct in stating that the model does not consider (presumably after the inventory draw-down period) "the feedback loop of excess inventory affecting production." However, since we constrained the model not to have an excess inventory, it is a moot point.

In the revised model in the RIA for the final standards, we have treated inventories, as well as demand, in an exogenous fashion, relying on a projection of inventory adjustments based on DOE/EIA's uranium industry model (EUREKA). Demand and capacity are linked together so that market closures due to changes in demand are calculated endogenously in the model. In the new demand projection used in the RIA, market closures are estimated for the years 1983, 1984, 1987, and 1997. In this manner, market closures are estimated separately from regulatory closures.

!*The Cost Estimates Are Inadequate and Not in Perspective*!

Comment 13: EPA's failure to even try to estimate actual compliance costs make it impossible to determine whether the estimated costs are reasonably accurate, whether a particular facility can comply at any cost, or whether a facility will be able to comply without interrupting production. (I-4(3).108)

Response: EPA disagrees with this comment. Realistic cost estimates are presented in the FEIS (Chapter 9 and Appendix B). The RIA economic analysis included consideration of wide range of situations, including different mill sizes, remaining lifetimes and sizes of existing tailings piles. EPA also allows up to 18 months for initiation of a protective action program (up from a proposed 12 months) for cleanup of contaminated groundwater. This is the only requirement that could possibly interrupt production. EPA believes 18 months is adequate for the initiation of corrective actions.

Comment 14: EPA's evaluation of the economic impact and benefit-cost analyses of various disposal methods or uranium mill tailings are merely rough estimates. Site-specific examination will show that many mills presently closed will not be reopened. (I-1(2).118)

Response: See the response to Comment 1, A.3.3.

Comment 15: EPA does not provide sufficient information on the risk and costs of compliance with its radium soil standard to allow its cost-effectiveness to be assessed. EPA should provide this information and allow public comment before promulgating its final radium in soil standard. (I-4(3).10)

Response: EPA has added an analysis of the radium in soil standard in the FEIS. EPA believes this radium in soil concentration limit has been sufficiently reviewed in past rulemaking proceedings to promulgate it without further public review and comment. See the FEIS-I, Volumes I and II.

Comment 16: EPA did not include in its analysis the costs of implementing a liquid management strategy and groundwater monitoring and response program which are necessary prior to closure or disposal, and which form the primary means of achieving EPA's primary objective relative to water pathway. (I-25.6)

Response: EPA did not include these costs in the RIA because they are relatively insignificant in comparison with tailings disposal costs, based on estimates reported in the background documents in support of the SWDA regulations. We have analyzed the extreme case whereby implementation of the SWDA regulations would result in tailings being placed in a new impoundment with a protective liner.

Comment 17: We are concerned that the economic impact analysis may be based on assumptions that are valid only for the short-term, but is being treated as though it includes all long-term costs for balancing against long-term benefits. (P-9(3).3)

Response: The economic impact analysis in the RIA covers the domestic uranium production through the year 2000. EPA believes that this is a suitable time period for estimating long-run economic impacts.

Comment 18: EPA should prepare a range of disposal costs to account for the likely effects of site-specific considerations. (I-25.7)

Response: EPA recognizes that site-specific conditions will produce variations in the estimated costs used in the economic analysis. Cost variations were accounted for in two ways: for existing piles costs for three different sizes were used; for future piles, above grade and below grade disposal costs were estimated. However, EPA did not attempt to estimate costs for site-specific variables, such as availability of materials, unique drainage patterns, etc., since the UMTRCA standards are generally applicable and such evaluations infringe on the prerogatives of the regulatory agencies.

Comment 19: It may be that if the full social costs of nuclear-generated electricity were internalized in the cost of the product, the market place would choose another alternative. A fundamental deficiency of EPA's benefit-cost analysis is that it does not consider costs in this broader context. (P-34.4)

Response: The comment is beyond the scope of the benefit-cost analysis of mill tailings standards. EPA has not explicitly analyzed the impact of the alternative standards on power plant selection. However, based on information presented in the industry profile chapter on the portion of electricity generation provided by nuclear power and the small percentage of nuclear generation costs represented by fuel costs, we do not believe that the standards will have any impact on power plant decision-making.

Comment 20: In 1982, DOE reported a 56 percent decline in $30.00 per pound or less, forward cost ore reserves from 470,000 tons to 205,000 tons. (I-1(2).116)

Response: Table 2.14 of the DRIA for the proposed standards contains the information presented in the comment.

Comment 21: EPA does not say how many pounds of uranium oxide are involved in the uranium contracts versus total demand. When prices in these contracts are compared to EPA's price forecast, no wonder a person draws the conclusion of a healthy mining industry. (I-1(2).117)

Response: See the response to Section A.1.1, Comment 28-22.

Comment 22: EPA errs in stating that a richer deposit "permits lower pricing." Richer deposits permit higher profits, or allow operations to continue when lower grade operations are forced to close. (I-15(2).6)

Response: EPA agrees. See the response to Section A.1.1, Comment 28-33.

!*Cost of Covers and Liners*!

Comment 23: Since radon emanation is a function of moisture content of the cover, EPA's Alternative F, based on two additional meters of cover, may over-estimate the cost of greater radon control. (P-4(H1).10)

Response: It is possible EPA overestimated the cost of greater radon control; however, it is unlikely. Control of radon is to be effective for the order of 1000 years. Over this period it is reasonable to expect moisture levels in cover material to approach local ambient levels in soils. Therefore, EPA did not use elevated moisture levels in calculating radon attenuation and thicknesses of cover material, but instead used ambient moisture levels. This leads to a thicker cover and, at least initially, lower radon emissions.

Comment 24: The cost of covering the tailings with 10 feet of soil to meet the radon emission limit in New Mexico would be high, not only in terms of construction expense but also in terms of environmental degradation due to heavy traffic and borrow pits. (P-28.1)

Response: EPA believes its cost estimates are realistic for most sites, including those in New Mexico. EPA also considered the environmental degradation caused by borrow pits and the cost of reclaiming such pits. EPA also considered the number of accidental and radiation-induced deaths that would occur for various disposal options. EPA considered the environmental impact of traffic only in the sense that it would be small compared to other impacts since suitable cover material is expected to be found close to most active sites.

Comment 25: When clay is available within a few miles of the tailings disposal area, clay liners can be installed for less than plastic liners. A 3-foot thick clay liner can be installed for approximately $.20 per square foot, while the cost of plastic liners installed range from $.50 per square foot to over $1.00 per square foot. (I-2(2).7)

Response: EPA agrees that if clay with suitable characteristics for liner material is found locally, the cost of clay liners is less than the cost of synthetic liners.

Comment 26: When one considers factors such as transportation costs and correct compaction it is questionable that clay would be cheaper than a synthetic liner. (I-16(H2-1).4, I-16(3).2)

Response: EPA agrees that the costs of clay liners are highly dependent on the distance the clay must be transported and somewhat dependent on compaction characteristics.

!*Additional Comments*!

Comment 27: EPA's assertion that its proposed standards are not "Major" within the meaning of Executive Order 12291 is very doubtful considering the projected costs of compliance. (I-4(3).106)

Response: The standards are classified as not "Major" because the incremental costs attributed to them are believed to be less than the criterion specified in the executive order. Regardless of whether or not the standards are major, EPA has proceeded as if they were and prepared a Regulatory Impact Analysis. The content of the RIA is the same in either case.

Comment 28: EPA's statement that mill tailings have no market value ignores the fact that some tailings have been reprocessed and that other resource recovery may be desirable in the future. (F-3(2).23)

Response: Other parts of the statement said the mill tailings are "essentially a waste product" and that "there is some small possibility for mineral recoverability." Since the amount of tailings that have been reprocessed, in relation to the total quantity of mill tailings in existence, is slight, EPA believes that the statement is correct as written.

Comment 29: Although the problem of foreign competition in the uranium market is discussed in the economic impact analysis, it is not used in any quantitative manner in the overall cost/benefit analysis. Perhaps some value in the cost/benefit analysis should be given to a healthy industry. (P-9(3).4)

Response: The benefit-cost analysis in the RIA relates the cost of controlling mill tailings to the gains in health protection estimated to be realized from control of these potential hazards. The analysis tries to determine the level of control that would maximize the net benefit (total benefits minus total costs) as viewed from the societal perspective. Issues such as establishing a healthy industry, are too broad to be addressed within the benefit-cost analysis. However, it is considered in the development of the standards.

Comment 30: We recommend EPA review a recent DOE study regarding commingled tailings (Commingled Uranium Tailings Study. DOE/DP-001, June 1982) to verify potential costs for land cleanup. (I-1(2).46)

Response: EPA estimates the cost to clean up land to the levels required by the standards to be about $21 million. EPA reviewed the DOE's commingled tailings report and found little information regarding cleanup of contaminated land.

Comment 31: EPA has not considered the future cost of drilling a well for water 500 to 1600 feet deep, rather than 200 to 250 feet, should groundwater contamination occur in the aquifers of the Upper Gallup Sandstone. (P-1(H2-1).12)

Response: EPA estimated the costs of preventing contamination of groundwater through the use of liners and by taking corrective actions. The total costs of these items are amenable to verification. Estimating the total costs of deeper drilling to obtain uncontaminated water is difficult since there are several unknowns, such as the depth to the uncontaminated aquifer and the number of wells that would be drilled. In EPA's analysis the fact that costs can be saved by not drilling deep for drinking water is considered a benefit.

Comment 32: Reasonable degradation should be allowed at existing impoundments when degradation results from a beneficial activity. Cost estimates to comply with EPA's proposed standards range from approximately $100 million to $200 million per site, or approximately $5 to $10 per pound of yellowcake produced. (I-1(2).25)

Response: EPA established its policy of nondegradation of groundwater after an extensive rulemaking proceeding under the SWDA. This proceeding under UMTRCA is not the forum for reopening this question. EPA believes these cost estimates for meeting the groundwater standards are reasonable. In fact, the commenter's estimates appear to be for moving existing tailings into new, lined impoundments, which would generally be done for long term stabilization, in most cases, if done at all, rather than for groundwater protection. The worst case in terms of costs for groundwater protection is construction and use of a new, lined tailings impoundment and in situ disposal of the existing pile. The costs for this "worst" case are substantially less than those made by the commenter.

Comment 33: The multi-layered controls required to comply with the proposed groundwater standard will cost between $61 and $250 million (depending on liner requirements for future tailings) during the operational phase at the Ambrosia Lake Mill. (I-6(3).53, I-6(H2).34)

Response: EPA believes these cost estimates are high, as discussed above in Comment 31. The worst case for the Kerr-McKee Ambrosia Lake tailings would be $27 million for disposal of the existing pile (Table B-8, FEIS) and $32 million for construction, use, and final disposal of a new, lined tailings impoundment (Table B-11, Method C3, FEIS). If closure costs are subtracted for the new impoundment, the cost of excavating and lining a new impoundment is $17 million, which can be compared to the commenter's estimates.

!*Specific Problems With the Cost Estimates in the RIA*!

Comment 34: It should be noted that in the RIA for active sites:

Comment 34-01: Re: Page 5-5, paragraph 3 - EPA falsely assumed that the industry demand forecast is unaffected by the EPA standards. EPA should consider the impact these "closure" standards will have on forcing utilities to go foreign for future supplies as domestic costs rise because of increased regulation and lower ore grades outpace foreign sources. (I-1(2).86)

Response: The revised methodology (discussed in Appendix B of the RIA) estimates the impact of each alternative standard on the ability of the conventional milling sector to supply the uranium that is necessary to meet demand. These impacts include any shifts from conventional production to imports or nonconventional production.

Comment 34-02: Re: Page 5-6, paragraph 4 - EPA used out-of-date information for its baseline projections. (I-1(2).87)

Response: A new projection of uranium industry demand based on the most recent projections made by DOE/EIA was used in this RIA and is described in Appendix B.

Comment 34-03: Re: Page 5-13, Table 5.5 - The table is based on out-of-date information. There have been further reductions and deferrals in nuclear generating capacity because of additional cancellations. (I-1(2).88)

Response: New projections of uranium industry demand and prices based on the most recent projections made by DOE/EIA were used in this RIA and are described in Appendix B.

Comment 34-04: Re: Page 5-14, paragraph 1 - EPA proceeds from a false assumption. Projections are based on out-of-date information and inaccurate cost data not based upon site-specific situations. (I-1(2).89)

Response: See the response to Comment 34-02, A.3.3.

Comment 34-05: Re: Page 5-19, paragraph 1 - If there is so much uncertainty about the uranium industry, EPA should not have proceeded with the standards and RIA until sufficient and accurate data was available. (I-1(2).90)

Response: UMTRCA does not allow EPA to refrain from setting standards because there is uncertainty about future industry activities. As the Congress has pointed out, there are substantial quantities of mill tailings existing today which may pose significant risks to people. Thus, there is a need for standards now regardless of future activity. Also, the uncertainty of future industry production primarily relates to the amount of future tailings generation and, therefore, the estimates of industry-wide disposal costs and health effects. The benefit-cost relationships of control of mill tailings, which contribute to the selection of the standards, are generally not affected by variations in the quantity of mill tailings forecasted in the future.

Comment 34-06: Re: Page 5-19, paragraph 2 - EPA proceeds from false assumptions. There is no "Buy American" phenomenon in the uranium industry. EPA bases this statement on a prediction of a "uranium broker." If EPA had consulted with DOE, this faulty assumption would have been dispelled. (I-1(2).91)

Response: See the response to Comment 3, A.3.3.

Comment 34-07: Re: Page 5-19, paragraph 3 - If this statement is related to EPA's limited references, then anyone associated with the industry can assume the agency did not spend much time evaluating the uranium business and economic situation. (I-1(2).92)

Response: By examining all the references used in developing the RIA, one would determine that this comment is incorrect.

Comment 34-08: Re: Page 5-20, paragraph 1 - EPA does not state how average production costs were developed. In data in Reference K, pages 131-139, DOE points out that very little domestic production is available under $30.00 per pound forward cost, whereas the entire U.S. demand could be fulfilled by foreign uranium at less cost than our lowest cost reserves. (I-1(2).93)

Response: EPA consulted with the staff of DOE/EIA on this issue, who replied that while current production costs may range from $20 to $50 per pound, $30 per pound was a reasonable number to use as an industry average. The higher the base production cost, the lower the percentage increase due to tailings disposal costs.

Comment 34-09: Re: Page 5-21, Table 5.10 - Table is wrong because it is not based on full economic recovery costs. (I-1(2).94)

Response: See the response to Comment 34-08, A.3.3.

Comment 34-10: Re: Page 5-26, Table 5.13 - The table should be based on the uranium divisions of the companies listed. In the case of Exxon and Atlantic Richfield, uranium sales amount to less than one percent of sales. EPA attempted to establish cost-benefit results upon "deep-pocket" scenarios. (I-1(2).95)

Response: The comment does not reflect a distinction between profitability and capital availability for a business segment within a larger company as did the different parts of our analysis. Rational capital budgeting decisions based on economic grounds require that a project is expected to be profitable in order to justify a capital investment in the project. The RIA states this in the following manner: "If an investment is not projected to be profitable, then there is no economic incentive to raise capital, even though the firm may have the ability to do so." Therefore, with respect to those items that determine profitability, the RIA did use information for the uranium business segment of the firms listed in the mill closure analysis. However, in examining the issue of capital availability, the RIA correctly focuses attention on the financial resources of the entire firm rather than merely the uranium business segment. The reason for focusing attention on the resources of the entire firm is that the normal business practice is for the firm to raise capital at the corporate level. This gives the firm access to a broader range of capital markets, and also achieves a better financing rate than would otherwise be the case.

Comment 34-11: Re: Page 5-27, paragraph 2 - We disagree with EPA analysis. EPA is attempting to build a case that the profitable oil and gas operations of some of the oil companies should be used to subsidize losses in uranium operations. (I-1(2).96)

Response: See the response to Comment 34-10, A.3.3.

Comment 34-12: Re: Page 5-28 and 5-29, Table 5.14 - We disagree with procedure. EPA should utilize the uranium division of the companies listed, not the total assets and sales. (I-1(2).97)

Response: See the response to Comment 34-10, A.3.3.

Comment 34-13: Re: Page 5-31, Table 5.15 - Again, we disagree with the procedure. EPA should utilize the uranium division of each company to evaluate whether uranium operations are profitable. (I-1(2).98)

Response: See the response to Comment 34-10, A.3.3.

Comment 34-14: Re: Page B-1, paragraph 2 - DOE data are out of date. Data are based upon 1979 information. Nuclear reactor capacity has been substantially reduced since 1979. (I-1(2).99)

Response: New projections of uranium industry demand and prices, based on the most recent projections made by DOE/EIA, were used in this RIA and are described in Appendix B.

Comment 34-15: Re: Page B-1, paragraph 3 - DOE data are out of date and no assumptions should be based upon this data. (I-1(2).100)

Response: See the response to Comment 34-14.

Comment 34-16: Re: Page B-1, Table B.1 - Data are out of date. There have been substantial nuclear reactor capacity reductions since the report was published by DOE/EIA in 1980. (I-1(2).101)

Response: See the response to Comment 34-14.

Comment 34-17: Re: Page B-3, paragraph 1 - Data are out of date. According to the Atomic Industrial Forum there are presently 147 nuclear reactors with operating licenses, under construction, or on order, representing 135 megawatts. (I-1(2).102)

Response: See the response to Comment 34-14.

Comment 34-18: Re: Page B-3, paragraph 2 - Data based on the EUREKA Model are out of date. (I-1(2).103, I-1(2).120)

Response: See the response to Comment 34-14.

Comment 34-19: Re: Page B-3, paragraph 2 - EPA states in Section 2, page 2-22 that reserves are listed by 'forward cost reserves' and do not include all previous exploration and development expenses and future income taxes, profits, cost of money. EPA states on page 2-22, "It is common practice in the uranium industry to obtain full costs by multiplying forward costs by 1.7." In Sections 2 and 5 of the RIA, EPA states the industry has a base forward cost of $30.00 per pound. Therefore, full recovery costs would be $51.00 per pound. Now, if full recovery costs are $51.00, how can EPA state in Appendix B they are $33.45 per pound in 1983 for the entire industry? (I-1(2).104, I-1(2).115)

Response: In the new projections described in Appendix B of the RIA, the uranium prices used are the annual delivered prices as estimated by DOE/EIA's uranium industry model (EUREKA). The comment is incorrect in reporting that "EPA states that the industry has a base forward cost of $30 per pound." The RIA assumes an industry average base "production" cost of $30, not a base "forward" cost. The production cost estimate represents all the costs of production, to which the incremental cost of tailings disposal is related.

Comment 34-20: Re: Page B-4, paragraph 3 - These data are extremely outdated. EPA has access to more current information. (I-1(2).105)

Response: See the response to Comment 34-14, A.3.3.

Comment 34-21: Re: Page B-4, paragraph 4 - Since EPA is using data which in some cases are five years old, EPA is "not qualified" to make price projections. (I-1(2).106)

Response: See the response to Comment 34-14, A.3.3.

Comment 34-22: Re: Page B-5, Table B.2 - Data are out of date. EPA has access to more current information. (I-1(2).107)

Response: See the response to Comment 34-14, A.3.3.

Comment 34-23: Re: Page B-6, paragraph 1 - EPA is not qualified to address the subject of mill closures. They should have relied on DOE or the NRC for projections on mill closures. (I-1(2).108)

Response: See the response to Comment 34-14, A.3.3.

Comment 34-24: Re: Page B-6, paragraph 3 - EPA relies again on out-of-date data. There was not any additional conventional milling capacity added in 1982 and 1983 and it is questionable whether there will be any in 1984. Why does EPA use 1980 projections in 1983? (I-1(2).109, I-1(2).121)

Response: See the response to Comment 34-14, A.3.3.

Comment 34-25: Re: Pages B-7 and B-8, Table B.3; Page B-11, Table B.5; Page B-12, Table B.6; Page B-16, Table B.8; Page B-17, Table B.9; Page B-19, Table B.10, Page B-20, Table B.11 - Data are out of date. EPA has no expertise in projecting uranium inventory drawdown or production. This responsibility is legislatively assigned to DOE. EPA did not consider the impact of foreign imports. EPA should have relied on EIA projections. (I-1(2).110)

Response: See the response to Comment 34-14, A.3.3.

Comment 34-26: Re: Page B-21, References for Appendix B - The references utilized in Appendix B relied upon three telephone conversations and one journal article. The references serve no solid basis for projections. (I-1(2).110)

Response: See the response to Comment 34-14, A.3.3.

Comment 35: Throughout the RIA, EPA addresses the current plight of the industry, but none of the statistical compilation supports this scenario. (I-1(2).111)

Response: All historical data displays in the RIA have been updated to contain the most recent published information available. Projections of uranium industry activities are also based on the most recent DOE/EIA projections. Therefore, the RIA reflects "the current plight of the industry" as described by these sources of information.

Comment 36: Section 2 of the RIA, Industry Profile, portrays the industry incorrectly because the data utilized are obsolete. (I-1(2).112)

Response: The data in the industry profile have been updated.

!Specific Problems with the Cost Estimates in the RIA -- The Cost Estimates are Rough and Not in Perspective!

Comment 37: Re: Page 2-24, paragraph 2 - It is not proper for EPA to arbitrarily use a $30.00 per pound cost figure based upon the reference in Business Week. EPA has access to more accurate data developed by DOE-EIA. (I-1(2).80)

Response: See the response to Comment 34-08, A.3.3.

Comment 38: Re: Page 2-8, paragraph 2 - EPA's analysis of new procurement in 1980 and 1981 indicates the majority of contracts are market priced. This means buyers will be paying less than present published Spot Market price and not over the projected $30.00 figure used by EPA to support the RIA in later chapters. (I-1(2).59)

Response: See the responses to Comments 34-08 and 34-14, A.3.3.

Comment 39: Re: Page 2-8, paragraph 3 - EPA's price determination is misleading since EPA does not state whether 5,000 or 5 million pounds are involved in the 1981-1990 deliveries. (I-1(2).60, I-1(2).61)

Response: See the response to Comment 28-22, A.1.1.

A.3.4 Cost Effectiveness

!Cost Effectiveness Analysis Is Not Adequate!

Comment 1: While EPA's cost/benefit analysis follows widely accepted methodology, it is deficient in many respects including: the judgmental aspects of the effectiveness index; the short time span considered; and the failure to consider cumulative impacts on future generations. Factors other than economic costs must determine the choice of control technology. (P-34.3)

Response: Economic costs are not the only factor which determines the selection of the standards. We have also addressed the maximum exposure of individuals, population health effects, and the technical practicability of implementing undemonstrated technology for control over very long periods of time, subject to legislative constraints.

Comment 2: EPA's inability to monetize benefits and the insensitivity of the "deaths avoided" calculation makes it essential that EPA base its cost/benefit analysis not on deaths avoided but on reductions in risk to the most affected individuals. (P-45.32)

Response: EPA recognizes the limitations of the "cost per radon death avoided" calculations and discusses these limitations in the RIA. Because of these limitations, we have examined other ways for basing the selection of the standards. However, these calculations do give one perspective on setting a level of control. The maximum risk to the individual is clearly another way of establishing the standard, and one which we have discussed in detail in the Preamble. We recognize that the maximum individual risk, even after control to the level required by these stanards, may still be relatively high. However, the practicability of providing more radon control below this limit falls rapidly.

Comment 3: The appropriate baseline for the cost/effectiveness analysis in the DEIS is the current NRC regulations, not the "no standard" alternative that was used. (P-4(H1).2, P-4(H1).3)

Response: According to PL 95-604, NRC must change its regulations to accord with EPA's standards. That NRC already has issued regulations for uranium mill tailings is irrelevant to EPA's analysis. (EPA's standards are in some respects more stringent and in others less stringent than NRC's regulations.)

Comment 4: EPA failed to properly evaluate costs and benefits by its failure to determine (1) whether risks at the level of control are significant, and (2) whether the incremental risk reduction achieved by additional controls is significant. Had EPA done this, it would have chosen a radon standard closer to 100 pCi/m^2-sec. (I-4(3).33)

Response: The questions are not relevant to a consideration of costs and benefits. In any case EPA determined that the risks (identical to incremental risks) are significant at the level of 100 pCi/m^2-sec, and can be cost-effectively reduced to the 20 pCi/m^{2}sec- level required by the standard.

!*The Standards Are Not Cost Effective*!

Comment 5: EPA is proposing to require a costly earthen cover, the success of which is unpredictable. EPA admits that the hazard, whatever its magnitude, could be controlled by far less expensive measures. However, the Agency rejects the less expensive measures - without evidence - on the claim they are unpredictable. In EPA's selective view, unpredictability is a bar to relatively low-cost measures, but not to high-cost measures, to control an uncertain hazard. (I-7(2).17)

Response: EPA does not agree that institutional controls are necessarily "far less expensive." In additional, we find the cost of earthen covers are justified by other benefits, e.g., radon emission control.

Comment 6: There are several approaches to covering a tailings pile which will endure for 200 to 1000 years and protect against the hazards EPA considers that are less costly than the three meters of earth required by EPA's proposed emission standards. (I-4(3).120, I-6(H2).7)

Response: EPA does not preclude the use of other approaches if they truly satisfy the standards.

Comment 7: If EPA had properly analyzed cover requirements, a one to three foot cover would have been selected as the most cost-effective. Using EPA's assumptions and estimates, allowing one-half meter covers would save 23 to 28 percent. Deleting the liner requirement would bring total savings to between 50 and 60 percent. Since all the benefits EPA deems important would still be achieved, such alternatives are clearly more cost effective. (I-4(3).121, I-4(3).122, I-4(3).123, I-4(3).124, I-4(3).67)

Response: We do not agree that such a cover would provide the benefits of a cover satisfying the standard. Further, regarding the "liner requirement" UMTRCA requires that there standards be consistent with EPA's regulations under the Solid Waste Disposal Act, wherein a liner is a primary standard for a new impoundment.

Comment 8: Notwithstanding EPA's acknowledgment that it cannot predict the extent of possible misuse of tailings in the future, the Agency has presumed to make just such a prediction in a table that purports to present the "Benefits of Controlling Uranium Mill Tailings at Active Mill Sites Through the Year 2000." 48 F.R. 19584, 19597. EPA's ascription in this table of the "chance for misuse," from "very likely" to "very unlikely," is totally speculative and in direct contradiction to the agency's acknowledgment of its inability to predict. (I-7(2).21)

Response: EPA's characterization is indeed speculative and expressed in the terms described because we do not believe it is possible to quantify the probable extent of misuse. These table entries represent our best judgements.

Comment 9: The small risks identified by EPA do not justify the costly solutions EPA has proposed. (I-6(H2).3, I-4(3).105, I-6(H2).30)

Response: The estimated cost for implementing these standards per death avoided is well within the range that has resulted from other health protection precedents, apart from other nonquantified benefits. See the response to Comment 14, A.3.4.

Comment 10: EPA has not demonstrated that its proposed groundwater regulations and liner requirements are "cost justified." (I-4(3).97, I-4(3).98, I-6(3).31, I-6(3).54)

Response: UMTRCA requires EPA to protect the environment as well as health. Risk to environmental resources like groundwater may warrant regulatory concern under UMTRCA, therefore, independently of the existence or not of significant risk to individuals. The seriousness of the threat of groundwater contamination is indicated by the fact that several existing piles already have groundwater contamination problems. The existence of a liner will assist the protection of groundwater by preventing or reducing migration of contaminants during the active phase of mill operation and for some period thereafter. This is an important function considering the apparent role the hydraulic head plays in migration of contaminants to groundwater.

Comment 11: EPA has failed to demonstrate the cost-effectiveness of its groundwater proposals, and the analysis with respect to cover and radon is deficient. (P-29.8)

Response: See the response to Comment 10, A.3.4.

Comment 12: The proposed standard, at approximately $1 million/health effect averted, is not cost effective. We estimate, adopting EPA's assumptions, that the actual cost of radon control alone ranges from $27,000 for Alternative C to $41,000 for Alternative F per year of life saved. These values represent 4 to 5 times the per capita gross national product, and are obviously disproportionate to the benefits obtained. (P-9(3).5, P-9(H1).10)

Response: The comment is incorrect. The proposed standard corresponds to Alternative D, not to Alternatives C, E, or F (the designations C, D, E, and F being taken from the DEIS and the Preamble for the proposed standards; the alternatives have since been redefined). The cost-benefit ratio for Alternative D is $72,000 per life saved, or $5,000 per year of life saved, not six to eight times higher, as asserted in the comment. This rate of spending is comparatively small for measures to protect public health, not large, as the commenter asserts.

Comment 13: EPA's groundwater standards may protect against degradation for a time, with great costs to industry, but will not better protect the public health. (I-11(2).9)

Response: It is not clear why the commenter concludes that avoidance of degradation will not better protect public health.

!Greater Protection Would Be Cost-Effective!

Comment 14: We estimate a total savings to Society of $5 to $10 billion for EPA's Alternative F compared with an industry cost of $709 million. Including estimates of the health risks in addition to fatal lung cancers would vastly tilt the cost benefit analysis in the direction which affords the greatest protection at a reasonable cost. (P-1(2).24)

Response: The benefits, as estimated in the comment, are derived by placing a value for avoiding a death on the total deaths avoided for all time by the control. EPA does not believe that human life should be monetized and then factored into an economic benefit-cost calculation to determine selection of the standard. Nonresolvable issues, such as equating expenditures made today with a stream of benefits occurring thousands of years into the future and determining acceptable values of avoiding death (valued at the margin or over all deaths avoided), make this an inappropriate procedure to follow in a rigorous manner. Chapter 4 of the RIA has, however, estimated the incremental cost per radon death avoided for alternative control levels and under a variety of health effect scenarios relating to time-frame and geographic distribution of estimated deaths. This type of comparison provides one with perspective on what the implicit value of an avoided death would be given the conditions of each scenario. EPA believes that these types of benefit-cost perspectives are useful in policy decision-making, but do not necessarily constitute the basis for the bottom line.

Comment 15: The total pass-through cost to the consumer for the radon control of alternative F is 7.5 to 9 cents/month. Given that in 1980 average electric bills ranged from $15.28 to $110.84, such costs are not burdensome. We believe that the vast majority of Americans would willingly pay this much for the benefits of improved human health and environmental protection. (P-45.33)

Response: EPA agrees that if the cost of disposal were entirely passed through to electricity rate payers, the size of the pass-through would be in the general ballpark of the estimates contained in the comment. However, EPA disagrees with the use of this measure as an indicator of economic impact of tailings disposal costs. Since the impact on rate payers for electricity consumption is several steps away from the production of uranium in the uranium fuel cycle, this measure does not capture the potential consequences on the activity to which this rulemaking directly applies. Let us assume that the domestic production of uranium is outlawed by some hypothetical rulemaking. If the production of nuclear-powered electricity is to continue, and assuming that the production cost advantage of foreign uranium sources versus domestic sources both continues and is reflected in uranium prices, then the impact of this hypothetical rulemaking on electricity consumers will register a reduction in electricity bills and not account for the impacts on the uranium milling industry or disruptions to other parts of the fuel cycle. We believe, therefore, that the use of this measure as an indicator of economic impact is misleading.

Comment 16: In the long run, maintaining a tailings pile on the floodplain would appear to be a much more expensive proposition than removal from the floodprone area. (F-1.5)

Response: We don't know that this is necessarily the case. Some piles in floodplains are subject only to high water floods, which are not necessarily destructive. Piles subject to high velocity water may, depending on site-specific circumstances, be adequately protected for very long times by dikes. We believe the comment should be considered in determining cost-effective, site-specific disposal measures that will comply with the standards.

A.3.5 Population Density-Dependent Standards

Comment 1: Although there is no provision in the Act for setting different requirements for remote sites, the Agency might justify some differences on the basis of its cost/benefit analysis. (P-5(H1).21)

Response: EPA has examined this issue carefully and found that, insofar as radon releases are concerned, the estimated lung cancers that might be induced nonlocally justifies controlling radon to the level of the final standard. Further details are given in the Preamble and the RIA.

Comment 2: The degree of radon control at remote sites should be equivalent to the degree of control at more densely populated rural sites. (F-1.8, F-3(2).21, P-26.5, P-26.4, P-33.7, S-1.1, S-3(H2).1, P-14(H2).2, S-12(H2).15, P-22(H2).3, P-1(2).32, P-1(2).34, P-1(2).63, P-33.9, P-33.12, P-32.4, P-44.4, S-3(2).21, S-12(H2).5)

Response: EPA agrees, for reasons given in detail in the Preamble. Among these is that demographers have concluded that it is not possible to determine that a population at a specific location will remain low in the future, if it is low now. Therefore, having two different standards implies a need for institutional oversight of future population shifts, and for upgrading the disposal at those sites that exceed some criterion of "remoteness." Presumably, the State or Federal custodian would be responsible, not the original owner. We believe such an arrangement is readily avoidable by applying adequate physical controls now to all sites. Also see the Response to Comment 1, above, and to numerous comments in Section 5.0 that involve reliance on institutional controls.

Comment 3: EPA should set a risk-based radon standard (rather than 20 pCi/m^2-sec) so that Agreement States have the flexibility (as permitted by the Act) to consider site-specific factors (including population density) in approving cover designs. Such a risk based standard would apply equally to sites located in remote and more densely populated areas. (F-6(2).9, F-6(2).13)

Response: Congress provided Agreement States with flexibility in choosing methods for satisfying EPA's standards and NRC's implementing regulations. We have found that remoteness is not a factor for which flexibility in the degree of control is justified (see the responses to Comments 1 and 2, above). Apart from that, the standard as written allows considerable flexibility regarding specific cover designs.

Comment 4: Alternate radon standards should be considered for remote sites since emissions from such sites have little effect on public health and safety. (F-5(3).6)

Response: As discussed in the Preamble, we found that the estimated health effects from remote uncontrolled tailings sites justifies controlling them to the level of the final standard.

REFERENCES

(1) National Council on Radiation Protection and Measurements, "Review of the Current State of Radiation Protection Philosophy," Report No. 43, Washington, D.C., 1975.

(2) International Commission on Radiological Protection "ICRP Publication 26," Pergamon Press, N.Y., 1977.

(3) United Nations Scientific Committee on the Effects of Atomic Radiation, "Ionizing Radiation: Sources and Biological Effects, 1982 Report to the General Assembly," U.N. Publication E.82.IX.8, United Nations, New York, 1982.

(4) National Academy of Sciences, "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation," Committee on the Biological Effects of Ionizing Radiations, NAS, National Academy Press, Washington, D.C., 1980.

(5) National Academy of Sciences, "Consideration of Health Benefit-Cost Analysis for Activities Involving Ionizing Radiation Exposure and Alternatives," "BEIR II" report, EPA 520/4-77-003, 1977.

A.4.0 STANDARDS FOR OPERATION

Comment 1: EPA's proposed operating requirements should be revised. Since liners will eventually leak, EPA should require: (1) Dewatering prior to or as part of emplacement disposal in deep below-grade trenches; (2) careful siting criteria specifying distance to the aquifer; and (3) permeability limits to isolate the tailings from groundwater and surface water. These requirements would also meet all of EPA's disposal criteria. They should be applied to all tailings generated two years after the effective date of this rule and to any existing piles that cannot be shown to achieve and maintain the air, water and longevity standards. (P-45.2, P-45.3, P-45.4, P-45.6, P-45.29, P-45.1, P-45.28)

Response: EPA agrees liners will eventually leak. However, they are expected to maintain their integrity during the operating period. After disposal primary reliance for groundwater protection is placed on the cap which prevents water migration into the tailings.

Dewatering tailings as part of emplacement in deep trenches is advantageous for groundwater protection. However, it allows increased emissions of radon (until the trench is covered) since water is the primary material that attenuates radon. EPA believes staged disposal methods including deep trenches, on balance, offer environmental advantages and encourages the use of such methods for future tailings in new impoundments. Dewatering at closure under regulations comparable to 40 CFR 264.228 is an NRC responsibility.

Specifying a (minimum) distance to the aquifer is an option for groundwater protection. However, such a criterion implies that distance to the aquifer, with the concurrent attenuation of hazardous constituents by soil, is an acceptable method for groundwater protection. This implication conflicts with the primary goal of SWDA standards for new impoundments - no seepage of hazardous constituents into the underlying soil or groundwater.

Permeability limits were rejected in favor of a synthetic liner requirement during extensive consideration under the SWDA. Since UMTRCA standards must be consistent with SWDA standards, there was no reason to reconsider this question in these proceedings.

EPA believes it is not necessarily more protective of the environment and public health to apply this commenter's suggested requirements to all tailings generated two years after the effective data. New tailings disposal methods would increase radon emissions until the old pile dries out and is covered and would also contaminate more land.

Comment 2: EPA should (1) require all impoundments to meet the design requirements of NRC Reg. Guide 3.11; (2) require neutralization of process solutions; (3) specify a minimum permeability of 10^{-9} cm/s for liners. (P-1(H2-1).8, P-1(2).50)

Response: (1) EPA incorporated 40 CFR 264.221 into these standards, which contains very similar requirements to NRC's Regulatory Guide 3.11. (2) EPA reviewed the advantages and disadvantages of tailings neutralization and concluded that a standard requiring neutralization would be inappropriate. (See Preamble) (3) See the response to Comment 1, A.4.0.

Comment 3: EPA should not adopt standards that interfere with uranium sand backfilling operations. Specifically, proposed 192.32(a) could be interpreted as requiring liners for future backfilling operations. Such a requirement would make backfilling infeasible. (I-6(3).73)

Response: "Backfilling" applies to placement of tailings in deep mines. This practice has several environmental and public health advantages and one disadvantage - the potential contamination of groundwater. Users of this method must still comply with the narrative requirements of 40 CFR 264.111, and NRC regulations comparable to EPA's SWDA regulations.

A.4.1 Design and Operating Requirements for Surface Impoundments (liner requirements, 40 CFR 264.221)

!*Liner Materials*!

Comment 1: Clay liners should not be allowed because they are not impermeable and they do not allow for a leakage protection system to be installed. Groundwater is so scarce in the West that it must be even more stringently protected than in areas where it is plentiful. Thus, the justification of a clay liner in western states is ill-conceived. (I-16(H2-1).5, I-16(H2-1).2)

Response: Under the requirements of 40 CFR 264.221 which is incorporated in UMTRCA standards, clay liners can only be used if they "prevent the migration of any hazardous constituents into the groundwater or surface water at any future time."

Comment 2: Clay liners are susceptible to cracking, and hence leaks, particularly in areas of fluctuating groundwater depth. (P-8(H1).24)

Response: EPA recognizes that clay liners may leak. It seems unlikely that a clay liner for a tailings pond will dry out until the tailings dry out; leaks without water will be inconsequential. Furthermore, a potential virtue of clay liners is their capacity to seal leaks that may form because of shifting foundations, inadequate installation, etc.

Comment 3: Use of synthetic liners will lead to a longer drying out period and may hinder final stabilization efforts because of moisture retention. This trapped moisture may also compromise long term stability. (I-4(3).70, I-4(3).90)

Response: A synthetic liner is intended to prevent the movement of liquids from the hazardous waste, or tailings, into underlying soil or groundwater or surface water during the operational period. The free water will have to be removed from the impoundment before the cover is installed. Drying out the impoundment may entail the use of evaporation ponds, recycling of liquids, and other methods to prevent movement of liquids into subsurface soils.

Comment 4: EPA should revise its liner requirements to allow operators the flexibility to determine the type of liner. RCRA regulations in effect stipulate a synthetic liner unless an exemption is granted, but such liners are generally unworkable at tailings sites associated with mineral extraction. Further, they require complicated drainage systems that require active maintenance and monitoring, which is directly contrary to the admonition in the Mill Tailings Act that active maintenance should be minimized. (I-6(3).56, I-6(H2).35, I-7(2).13)

Response: As discussed in the Preamble, the final standards allow use of either synthetic or natural liners. Under the SWDA (RCRA) standards, liners are relied on for groundwater protection during the operational period of an impoundment. After closure (disposal) of an impoundment, groundwater protection is provided by the cap (cover). The UMTRCA admonition refers to the disposal period.

Comment 5: The EPA should obtain supporting information on the desirability of synthetic liners before requiring their use. (I-12(2).7)

Response: EPA is continuing to evaluate the performance of synthetic liners. Based on current information synthetic liners have a reasonable likelihood of achieving the goal of the standards, i.e., to minimize the migration into the environment of hazardous constituents in land disposal units.

Comment 6 EPA's confidence in synthetic liners is without basis. Careful site selection and clay liners is the best way to minimize seepage and leakage. Therefore, EPA must allow the flexibility to use natural materials for liners. (S-13(H2)

Response: Based on the goal of the standards (see response to Comment 5 above), the EPA selected the liner material that was at least potentially capable of meeting the goal.

Comment 7: The EPA groundwater standard should protect groundwater on the basis of its potential use. On this basis, the EPA should allow clay liners. (F-6(2).14)

Response: We have indicated in many other responses that standards based on potential use would not satisfy UMTRCA's requirement for consistency with EPA's standards for hazardous wastes. However, clay liners are allowed, under very strict conditions. See the response to Comment 1, A.4.1.

Comment 8: Clay liners are "impermeable" to waste constituents of concern, despite the fact that they may not be as "impermeable" to the actual water. This is because the clay has such ideal geochemical removal capabilities that it allows the passage of water and certain of the conservative contaminants such as sulfate, but fixes the bulk of the toxic and radiochemical contaminants. (I-27.5, I-2(2).9.)

Response: EPA has reviewed the performance of clay liners in removing inorganic materials from leachate and has concluded clay liners are not necessarily effective in removing certain hazardous inorganics, such as selenium, arsenic, and molybdenum.

Comment 9: Section IIB of the Preamble suggests that clay liners deteriorate under the action of acid solutions. Geochemical test work has shown the contrary, due to the interaction between acidic solutions and calcite minerals present in the clay. (I-27.2)

Response: The interaction of acidic solutions and calcite minerals in clay has been considered in Appendix D of the FEIS.

Comment 10: If EPA allows clay liners it must specify the type of clay to be used or the properties it must possess. (P-16(H2).1)

Response: There is no need to specify the type of clay or its properties since clay can only be used as a liner material under conditions that prevent the migration of any hazardous constituents into the groundwater or surface water at any future time.

Comment 11: An effective synthetic liner system requires a double liner and a leak detection system. Such systems are available at reasonable cost. A single synthetic liner with groundwater monitoring should not be allowed since the damage is done before it is detected. The minimum thickness for synthetic liners should be 80 mil, not the 30 mil specified by EPA for hazardous waste storage. (I-16(H2-1).1, I-16(3).1, I-16(H2-1).3)

Response: EPA selected use of synthetic liners as a primary standard, as specified in 40 CFR 264.221 and 264.228, after an extensive rulemaking procedure under the SWDA. The SWDA rules recognize the advantages of double liners, however, by exempting sites where they are used from certain monitoring requirements. There is little reason to reconsider such general issues in this forum.

Comment 12: Combining clay and plastic liners may be the most effective means of retaining tailings wastes. We suggest that a typical liner should be comprised of layers of bentonite, fabric filter, liner, and sand. (S-1.9, P-49.9)

Response: The virtues and limitations of liner systems are discussed in Chapter 7 of the FEIS and in the Preamble. EPA believes that all liner systems pose some potential problems. See the response to Comment 11, A.4.1.

!Site-Specific Soil Characteristics Should Determine Need for Liners!

Comment 13: All new tailings should be placed on liners. However, when natural material underlying the site have the characteristics of a good liner, the requirement to use other liner materials should be waived. (F-1.2)

Response: The UMTRCA standards require new tailings to be placed on liners at new tailings impoundments and extensions of existing impoundments. However, new tailings can also be placed on existing piles if environmental requirements are met, since this leads to lower radon emissions and less contaminated ground surface than starting new impoundments. There is an exemption procedure (40 CFR 264.221(b)) for situations involving good local materials.

Comment 14: EPA estimates that for a new tailings pond (EPA model) a clay liner would cost $12 million (1981 dollars) and a Hypalon liner would cost $10.9 million (1980 dollars). Analyses to demonstrate the need or lack of need for liners would be a fraction of this amount. Contrary to EPA's conclusion discounting detailed site-specific analyses of hazardous waste sites, the cost-benefit of analyzing the site prior to commitment of such funds is certainly warranted. (I-1(2).10)

Response: EPA recognizes the cost advantages of not installing liners and has provided an exemption procedure (40 CFR 264.221(b)).

Comment 15: The general requirement for synthetic liners should be dropped and replaced with a requirement for adequate control of migration based upon site-specific characteristics, including geotechnical, geological, hydrological data and proximity to present and future groundwater use. Such an approach may prove in many cases that a liner requirement is redundant for groundwater protection. (I-2(2).9, I-30.10)

Response: EPA concluded a liner was required as part of a comprehensive liquid management program during an extensive rulemaking procedure under SWDA. It was recognized however, that at certain locations a liner might not be needed and an exemption clause was provided. See the response to Comment 14, A.4.1. Some, but not all of the factors the commenter recommended are to be considered in granting an exemption.

Comment 16: Synthetic liners do leak. Only the site-specific characteristics of the sub-strata will determine the site-specific impacts of a leak. (I-1(2).6)

Response: EPA agrees with this comment. The secondary standards were written to provide protection when liners leak, including requirements for monitoring and corrective action programs.

!Set Permeability Limits Instead of Specifying Liner Material!

Comment 17: EPA should simply specify a minimum permeability of 10^{-9} cm/s for any liner. This would avoid technical disputes over what are appropriate materials, and allow liner decisions to be made on a site-specific basis. (P-1(2).49)

Response: EPA believes there is no need to specify a minimum permeability for any liner since synthetic liners are required. In extraordinary situations where clay liners might be applicable, there are numerous other considerations that tend to minimize the importance of the liner permeability.

Comment 18: We support EPA's liner requirement, except there should not be any exemptions. EPA should require any alternative to a synthetic liner to achieve a seepage rate of less than one foot/1000 years. (P-26.13, P-1(2)39)

Response: EPA intends the liner exemption to be applied only where the environment would be very well protected without a liner. (See 40 CFR 264.221(b).)

!Exempt Lateral Extensions From The Liner Requirement!

Comment 19: We support EPA's intent to allow continued use of existing piles so long as appropriate groundwater standards are met. 40 CFR 192.32 should be modified to allow lateral expansion of existing tailings retention areas without mandating use of a liner. Since appropriate groundwater standards must be complied with in all cases, this proposed modification to Section 192.32 remains consistent with the goal of protection of groundwater uses. (I-1(2).13, I-1(2).11, I-6(3).3, I-6(3).55, I-6(H1).17, P-24.5, I-19.6, I-6(4).13, I-7(2).12, I-7(2).15))

Response: In the mill tailings case, EPA determined that there was no reason to allow lateral expansion of a pile without requiring a liner or its equivalent. See the response to Comment 20, A.4.1.

Comment 20: Application of a liner to lateral expansions of existing tailings piles is not justified. To impose a liner requirement at this juncture will not significantly decrease any subsoil or groundwater degradation that may have occurred to date or that could ultimately occur from the existing portions of tailings ponds. (I-1(2).12, I-2(2).8)

Response: Applying a liner requirement to lateral extensions of existing impoundments will limit the potential source term to that from the area of the existing impoundment. This could be a significant limitation, depending on the relative areas of the existing versus new (lateral extensions) impoundments.

!The No Migration Requirement Is Not Feasible Or Necessary!

Comment 21: EPA's proposed liner requirements effectively impose the mandatory nondegradation standard for groundwater protection developed for hazardous wastes under SWDA. (I-28.4)

Response: EPA knows of no rationale that would justify changing the fundamental protection policy of nondegradation of groundwater quality. Also, no rationale was presented in public comments that would justify less restrictive standards for uranium and thorium mill tailings than for other hazardous wastes.

Comment 22: In certain cases nondegradation is too restrictive, and a synthetic liner is not really needed. (F-3(2).12)

Response: This view was considered in the extensive rulemaking process for developing the SWDA standards. This proceeding is not the forum to review basic changes in the rationale for the SWDA standards.

Comment 23: The "no migration" requirement is technically unfeasible as (1) all liners, under normal operating conditions, eventually leak, and (2) some facilities allow leakage that actually enhances the stability of the tailing basin structure. (I-2(2).3)

Response: The "nondegradation" or "no migration" policy of EPA is the goal of the SWDA primary groundwater protection standard and is the rationale for the liner requirement. Since EPA recognizes some liners may fail, secondary standards were established as concentration limits of hazardous constituents in groundwater based on the "nondegradation" policy for such constituents in groundwater. Designing surface impoundments to intentionally leak into underlying soils or groundwater is prohibited, even if it means a more costly design (clay core dams, etc.). Existing impoundments that leak may continue to be used provided the secondary standard is satisfied, which may require corrective actions to be taken.

Comment 24: EPA's zero discharge requirement for new retention areas is inconsistent with its own findings that "any liner will begin to leak eventually". EPA should allow the continued use, as recommended by NRC, of cost-effective clay liners. (I-28.5, I-22.10, I-9(2).6, F-6(2).2)

Response: EPA's analysis indicates clay and synthetic liners cost about the same. However, synthetic liners are capable of retaining liquids whereas clay liners allow passage of some liquids. Therefore, synthetic liners can fulfill the groundwater protection goal and have been adopted after an extensive rulemaking process under SWDA.

Comment 25: Ground water contamination at existing mills should be dealt with by minimizing and containing seepage within the site boundaries as specified by NRC guidance. Eliminating seepage is not cost-effective or necessary to protect public health. (I-11(2).8, I-30.11)

Response: Subject to certain criteria, the UMTRCA standards allow the NRC to establish alternate concentration limits within the site boundary up to 500 meters from the edge of the disposal area. Eliminating seepage from hazardous waste management units is the goal of EPA's program under SWDA.

Comment 26: EPA's requirements for obtaining an exemption to the synthetic liner requirement cannot be met. How does one prove no migration of hazardous wastes in perpetuity?

Response: 40 CFR 221(b) indicates criteria that will be considered in this determination. Consider, too, that hazardous constituents may no longer be mobile after a site has been closed in conformance with the SWDA regulations.

Comment 27: Please explain the "no migration policy" of the Agency based upon synthetic liners with a 15-year life expectancy. Why does EPA assume a 15-year liner life when experience shows frequent failures after one or two years? (P-8(H1).3, P-8(H1).23)

Response: The capabilities of plastic and natural liners are reviewed in Chapter 7 of FEIS. The "no migration policy" (or "nondegradation policy") is described in detail in the Federal Register notice (47 FR 32274, July 26, 1982) containing the SWDA standards. While experience to date indicates concern with the performance of synthetic liners, much of this experience is based on inadequate choice of liner material, chemical resistance testing, and installation. Quality control programs are essential to the successful use of synthetic liners. EPA issued a secondary standard to control the consequences of liner failures.

!No Exemption to Liner Requirements!

Comment 28: The rule that the NRC would be required to implement would be the first instance where RCRA would be applied to a broad industrial category. We believe that the feasibility of technical alternatives need further study before RCRA standards are applied to uranium mill tailings. (F-6(2).4)

Responses: The RCRA (SWDA) rules, having been issued in their present form in July 1982, were developed for national application to a large number of diverse hazardous waste sites. UMTRCA, as amended, directs EPA to issue standards for uranium mill tailings before October 1, 1983 and requires such standards for nonradiological hazards to be consistent with the SWDA standards. We have applied modified standards to tailings where we found differences between tailings and hazardous wastes that justified such changes. In view of the broad applicability and scope of the hazardous waste standards, the congressional directives, and a lack of compelling justification in our rulemaking record that would support deferring standards, we are issuing standards now. We note that UMTRCA provides EPA with authority to revise the standards. EPA intends to monitor the implementation of these standards in order to keep informed of their workability in the present form.

Comment 29: Existing operations should not be exempted from the liner requirements. (P-30.5, P-36.2)

Response: EPA considered this alternative and rejected it based on the increase of radon emissions until the existing pile is dried out and covered and also on the increased amount of land that would be contaminated and removed from productive use, essentially forever. However, new impoundments with liners may be the only suitable corrective action at some existing sites where corrective actions are required.

Comment 30: EPA's provision which allows new tailings to be placed on existing piles does not protect the public, provides an incentive to employ substandard tailings disposal practices, and rewards producers who contribute most to the problem. (P-4(H1).8)

Response: Requiring all new tailings be placed in lined impoundments would provide mixed blessings. While this alternative may reduce groundwater contamination if the new lined impoundment does not leak, it also increases radon emission because of the larger tailings area, both during operations and after disposal. It also contaminates more land and effectively remove this land from production forever. On balance, EPA believes the continued use of existing piles and impoundments is preferrable to starting new impoundments if groundwater can be adequately protected, as under the secondary standard.

Comment 31: Considering the experience of five New Mexico sites, liners should be required at all existing facilities. (P-1(H2-1).11)

Response: See the responses to Comments 29 and 30, A.4.1. EPA believes alternative corrective actions should be considered and tested before drawing blanket conclusions such as this.

Comment 32: Although liners may not be effective for long term isolation, they provide the best currently available control and should be required at all disposal sites. (F-3(2).9)

Response: See the responses to Comments 29 and 30, A.4.1.

!*Additional Comments*!

Comment 33: EPA's liner requirements appear adequate to protect groundwater. (P-9(H1).15, F-2.3, P-23.2, P-49.7)

Response: EPA agrees with this comment.

Comment 34: EPA's exception to the monitoring requirements of 40 CFR 264.228 is appropriate, since ownership will be transferred to the government after stabilization. (I-6(3).47)

Response: EPA did not incorporate or except the monitoring requirements of Part 264.228. The regulatory agency will establish post-closure monitoring requirements.

Comment 35: In some cases use of a liner would be technically unsound and could create serious environmental problems. (I-6(H2).19, I-6(4).14)

Response: This comment relates to the "bathtub" effect that can occur in surface impoundments when there is little or no seepage through the bottom and water is allowed to infiltrate into the impoundment. EPA considered this condition and concluded that proper disposal methods at "dry" sites would be likely to prevent this from occurring. At "wet" sites, however, this condition could lead to serious environmental problems. Therefore, the post-closure standards require a cover (cap) that is less permeable than the liner or underlying soil at "wet" sites.

Comment 36: EPA's proposed liner requirements, without meaningful allowance for exemptions, is arbitrary and inappropriate. As EPA acknowledged in its FEIS on Inactive Mills, potential contamination must be considered on a site-by-site basis. Thus, liner requirements must be determined on the basis of site-specific factors. (I-4(3).89)

Response: EPA selected standards requiring liners based on a no migration policy after an extensive rulemaking procedure under the SWDA. Standards under the UMTRCA are required to be generally applicable and consistent with SWDA standards. There is no reason to treat mill tailings differently from other wastes. The UMTRCA rulemaking procedure is not the forum for changing basic policy and rationale regarding groundwater protection.

Comment 37: The liner requirements are unnecessarily restrictive and unnecessarily costly. Even without consideration of water table levels, the requirements appear to be excessive when the attendant risks are fully evaluated. (I-5(2).9)

Response: EPA disagrees that the liner requirements are unnecessarily restrictive and costly. They are consistent with SWDA requirements and EPA policy regarding groundwater protection

Comment 38: To require mill operators to transfer all tailings already deposited in an unlined tailings pond to a lined tailings pond is arbitrary, capricious, and a waste of money with no defined benefits. No definable impacts have been noted and none are projected on groundwater resources downgradient of the authorized permit boundary. (I-1(2).26)

Response: EPA considered the costs and benefits of moving tailings from their existing piles to lined impoundments primarily for prevention of massive spreading of tailings by floods. Furthermore, tailings need not be moved to comply with the groundwater standards, because other corrective actions will usually be available. See the response to Comment 7, A.4.2. Therefore, this alternative was not considered in the final EIS.

Comment 39: EPA should consider osmotic action occurring within the tailings ponds, which tends to bring vadose zone water into the ponds. (I-27.6)

Response: EPA considered this phenomenon among others (see Chapter 3, FEIS) and concluded it would not lead to serious groundwater contamination problems.

Comment 40: For reclamation purposes, the benefits of removing water contained in tailings sands during operations can certainly outweigh the benefits of preventing seepage during operations. EPA fails to address various methods utilized to drain water retained in tailings by using limited controlled leakage, drains on top of liners, sumps, or other mechanisms. (I-1(2).5)

Response: Water in tailings reduces radon emissions from tailings during operations. However, to the extent that these standards are still satisfied, water can be removed from tailings to achieve other benefits. Closure requirements (40 CFR 264.228) for surface impoundments include elimination of free liquids by removing liquid wastes.

Comment 41: Evaporation cannot be relied upon to significantly dry a tailings mass due to the typically low permeability of tailings material and the great thickness of most tailings deposits. Minimization of seepage by use of a liner will result in preservation of the saturated condition of the tailings deposits for many years. (I-30.12)

Response: EPA considered this question and used a five year dryout period for its analysis. The tailings will retain significant quantities of water that is chemically attached, whether there is a liner or not. Stabilization of piles should take place when they have dried sufficiently to permit contouring and covering using heavy equipment.

Comment 42: It is interesting only EPA differentiates between active (including future) and inactive sites. (I-1(2).7)

Response: There are two parts of the Uranium Mill Tailings Radiation Control Act that involve EPA: Title I - Remedial Action Program, which addresses "inactive" sites, and Title II - Uranium Mill Tailings Licensing and Regulations, which addresses existing and future licensed sites. EPA is separately directed to establish standards for each part.

!*Alternative Requirements*!

Comment 43: We believe siting and design of impoundments should be in accordance with NRC Reg. Guide 3.11, except the criteria for flooding should be the probable maximum or maximum credible event rather than a 100-year event. (P-1(2).51, P-1(H2-1).8)

Response: EPA agrees with the thrust of the comment. Also, Subpart K - Surface Impoundments (40 CFR 264.221) has requirements similar to those of NRC's Regulatory Guide 3.11.

Comment 44: EPA should adopt the provisions of NRC Reg. Guide 3.11 and the proposed NRC guide for liners at uranium mills as requirements for all new facilities, additions to existing facilities, and disposal sites to which existing tailings are moved. (P-26.15, P-49.10)

Response: EPA incorporates 40 CFR 264.221, which has similar requirements to NRC's Regulatory Guide 3.11, into these UMTRCA standards.

Comment 45: Disposal on barren bedrock should be prohibited if the bedrock exhibits fracturing, faulting, or other potential stability problems, or if it has hydraulic conductivity greater than 10^{-9}. (P-26.14)

Response: The comment appears reasonable.

Comment 46: A "relatively impermeable" liner is preferable to an "impermeable" liner, as proving impermeability is difficult. Further, a well designed cap on the tailings at the end of operations would reduce the potential for leachate loss through a relatively impermeable liner. (F-3(2).13)

Response: A "relatively impermeable" liner could allow seepage into the soil underlying an impoundment or the groundwater and thus might not achieve the environmentally preferable goal of "no seepage." The decision will be up to the regulatory agency.

A.4.2 Ground Water Protection

Comment 1: EPA seeks to prevent the addition of tailings to existing piles, yet states, "Subsurface soils beneath existing, unlined impoundments are usually already contaminated. The groundwater beneath these contaminated soils may or may not also be contaminated. However, if it is, corrective actions must be taken to achieve compliance with the groundwater protection standards. This situation (contaminated subsurface soil and, possibly, groundwater) exists regardless of whether or not new tailings are added to existing impoundments." (I-1(2).24)

Response: EPA does not seek to prevent the addition of tailings to existing piles. The only identified situation in which these UMTRCA standards would cause cessation of adding tailings to existing piles is where construction and use of a new lined tailings impoundments is the only feasible corrective action.

Comment 2: The same site-specific considerations EPA has agreed should govern whether and to what degree to restore an aquifer at an inactive site should be used to evaluate the degree of protection required for an aquifer at an active site. (I-1(2).17)

Response: Most groundwater contamination appears to be caused during the operational period of an impoundment when process water pumped with tailings into the impoundment creates a hydraulic head that causes seepage into the underlying soils and aquifers. Once this pumping stops and the pile dries, there is no driving force to cause such seepage. Since the inactive piles have been out of use for years, new groundwater contamination is now thought to be slight at these sites. See the response to Comment 16, A.4.2.1.

Comment 3: Many of the first generation uranium facilities were sited in locations totally inappropriate to the present regulatory climate. As a result, there has been migration of contaminants for finite distances downgradient from the facility. Despite this, geochemical removal mechanisms have generally been successful in cleaning up the radiochemical and toxic contaminants. I would recommend that the existing sites be allowed to operate, under monitored conditions, until the end of the useful life of the facility, at which time the site could be reclaimed and a program of groundwater monitoring continued. (I-27.11)

Response: EPA agrees with this comment, with the addition that corrective actions be taken at sites where the groundwater standards are exceeded. At a minimum, these standards require that the contaminants pose no substantial present or potential hazard.

Comment 4: Because many of the existing piles already have contaminated groundwater beyond the standards of Section 264.94(a), the regulatory agency is going to be forced into the alternative concentration limits of Section 264.94(b). The important thing is to protect those groundwaters that are not yet affected and this should be EPA's minimum performance criterion in these situations.

Response: EPA believes that groundwaters that are not yet contaminated should be protected and, also, that contaminated groundwater should be cleaned up to the extent required by the secondary standard.

Comment 5: We believe the concept of primary groundwater protection should be followed, but the rules should allow seepage requirements to be established for each site based on site-specific conditions. (F-3(2).14, I-4(3).103)

Response: In rare instances site-specific conditions can be considered to allow exemptions from the liner requirements under 40 CFR 264.221(b). Site-specific conditions can be considered for existing sites regarding monitoring programs and corrective action requirements, and in determining whether exceptions to the basic requirements of the secondary standard should be allowed.

Comment 6: Ground water must be protected. (P-6(2).1)

Response: EPA agrees with this comment.

Comment 7: The EPA should describe those cases where "more permanent protection" for tailings disposal sites is required, and proposed 40 CFR Part 192 should indicate, with such specificity as is reasonably possible, when an alternate site for processing operations or disposal shall be used. (S-5.12)

Response: Choosing alternative sites is simply a method for satisfying the standards, not a component of the standards per se. We discussed using alternative sites (Preamble to proposed standards, page 19590) to indicate that such methods should be considered when engineered protection measures could not assure adequate long-term control of water pollution at an existing tailings site. Based on site-specific factors the regulatory Agency should decide when alternative siting is necessary for compliance with the standards. See the response to Comment 38, A.4.1.

Comment 8: Where tailings piles extend below the water table, removal of the piles to other sites or special isolation measures, such as containment walls or slurry dikes, should be considered. (F-1.1)

Response: EPA agrees. The post-closure standard adopts by reference 40 CFR 264.111, which requires the facility to be closed in a manner that controls, minimizes, or eliminates post-closure escape of such leachate to the groundwater.

A.4.2.1 Standards (40 CFR 264.92)

!Basis for Standards (40 CRF 264.92)!

Comment 1: EPA clearly has the statutory and regulatory authority to prevent movement of radioactive and toxic materials into groundwater of current or future use at the point of use. (P-1(2).1)

Response: EPA agrees with this comment.

Comment 2: We believe nondegradation is the proper standard, but question the ability of synthetic liners to restrict water and contaminants from reaching the groundwater. (P-3(2)-3)

Response: See the response to Comment 27 of Section A.4.1.

Comment 3: A certain degree of misfit is evident when trying to adapt RCRA regulations to uranium tailings management. (I-10.3)

Response: EPA considers that certain of its responsibilities for hazardous wastes controlled under the SWDA, as amended, are made the responsibility of the U.S. NRC under the UMTRCA. Examples of these responsibilities are listed in the Preamble.

Comment 4: On what basis does EPA conclude that radionuclides and heavy metals in the seepage will not reach groundwater? It is common knowledge that it is very difficult to remove these contaminants once they reach groundwater.

Response: EPA did not conclude that radionuclides and heavy metals will not reach groundwater. Nondegradation standards and concentration limit standards are established for these substances.

Comment 5: EPA has interpreted Section 275b.(2) as requiring regulation of nonhazardous constituents to be the same as regulations under Subtitle C of SWDA. We believe that a consistent reading of Sections 275b(2) and 84a(3) of the AEA allows EPA more latitude, and thus EPA can formulate less rigid and restrictive groundwater standards. (F-6(2).5)

Response: The statute requires that the standards be "consistent." EPA interprets this to mean that it should follow SWDA standards unless a reasonable basis for differentiation exists between mill tailings and hazardous wastes.

Comment 6: EPA has not adequately considered the voluminous evidence in the literature and in Federal Government contractor reports that conflict with EPA's assumptions on the need to control tailings and seepage from tailings. (I-30.9)

Response: EPA established the SWDA standards and regulations after an extensive rulemaking procedure which included consideration of a vast quantity of information.

Comment 7: EPA should not allow degradation of existing groundwater supplies from their current or potential use. But, we do not support EPA's proposal to subject uranium processing operations to the groundwater standards developed for community drinking water supplies and applied to hazardous waste facilities under SWDA. (I-4(3).92, I-5(2).6, I-6(3).6, I-6(3).62, I-11(2).5, F-6(2).1, F-6(2).6, F-6(2).14, I-30.15, I-10(2).13, I-10(2).15, I-10(2).16, I-4(3).103, I-7(2).7, I-10(2).15, I-10(2).13, S-12(H2).10, I-6(H2).14, S-13(H2).3, P-28.5, I-22.13)

Response: The major issues raised in these comments were considered by EPA in establishing the SWDA standards for hazardous waste facilities. Congress directed EPA to issue standards for uranium mill tailings that are consistent with the SWDA standards. A fundamental goal of the SWDA standards is to protect groundwater from degradation by waste, in the first instance by preventing contaminants from entering the ground, and, failing that, by preventing hazardous constituents from degrading the quality of groundwater. The SWDA standards provide for exemptions from and alternatives to the basic standards to be granted site-specifically, when doing so would not pose "a substantial present or potential hazard to human health or the environment." Granting such exemptions and alternatives is based on examination of certain specified factors (see 40 CFR 264.93(b) and 40 CFR 264...94(b)), which include most of the factors the commenters would have EPA consider in establishing standards. The standards we are issuing for uranium mill tailings are consistent with the SWDA standards; standards based on the commenter's recommendations would be inconsistent.

Comment 8: There is no reasonable basis for imposing radium and gross alpha concentrations developed for drinking water systems to unused (and often unusable) aquifers, at locations long devoted to mineral extraction, or at locations where such limits would foreclose the development of resources. (I-6(3).67)

Response: Water whose radium and gross alpha concentrations are lower than the values in Table A (which are the same as in EPA's drinking water standards) may be degraded up to those values under the UMTRCA standard. Water whose "background" concentrations of these substances exceeds the values in Table A may not be degraded by tailings. This standard follows the environment and health protection policy adopted in the SWDA regulations for nonradioactive substances. Some of the factors the commenter discusses may be taken into account in determining site-specifically whether alternative concentration standards are to be granted. Also see the response to Comment 1, A.4.2.3.

Comment 9: EPA's proposed nondegradation standard for uranium which protects all groundwater regardless of potential use or cost of control is contrary to radiation protection philosophy and ALARA. (P-9(3).13)

Response: We don't consider this a radiation standard. Based on their presence in tailings, their environmental mobility, and their toxicity, we added uranium and molybdenum to the list of hazardous constituents for this rule. These substances thereby become subject to the standards EPA had already adopted for nonradioactive hazardous constituents under the SWDA. See the response to Comment 7, 4.2.1.

Comment 10: EPA's nonmigration standards do not take into account either the fact that some facilities were designed to allow limited seepage to enhance stability, or the difficulty in installing a retention system that will not leak over the 200-1000 year regulatory time frame. EPA should take these facts into account and propose standards based on the quality of use concept used by some states. (I-25.3, I-20.3)

Response: With respect to the operating period of the mill, see the response to Comment 7, A.4.2. With respect to the post-closure period the applicable requirement is to close the impoundment in a manner that ...controls, minimizes, or eliminates, to the extent necessary to prevent threats to human health and the environment, post-closure escape..." of hazardous waste, etc. After closure, whether or not the system was designed to leak during operations is not material; the primary method of satisfying the closure standard is to keep water from entering the impoundment.

Comment 11: Ground water resources can be adequately protected by allowing some degradation within groundwater classifications based on both current and reasonable future use. Where the current and future impacts on groundwater resources have not only been defined, but also mitigated via containment in a "buffer zone", protection of public health and the environment is secured. I-1(2).22, I-1(2).18)

Response: See the response to Comment 7, A.4.2.1. Note that the final standard provides a feature (192.32(a)(2)(iv)) that some people may regard as permitting a very limited "buffer zone."

Comment 12: EPA should base its standards on nonimpairment of use (the quality of use concept), and should provide an exemption procedure if the licensee can show the costs of meeting the standards outweigh the benefits and compliance is not necessary to protect public health and the environment. (I-10(2).19, I-10(2).18)

Response: See the response to Comment 7, A.4.2.1.

!The Standards Have No Risk Basis or Are Unsubstantiated!

Comment 13: The proposed standards are not health based, and are impractical, arbitrary, unlawful, and inconsistent with existing regulations without a reasonable basis. EPA should adopt standards similar to New Mexico's. (I-7(2).2, I-7(2).5)

Response: See the response to Comment 7, A.4.2.1.

Comment 14: EPA's proposed nondegradation standard is arbitrary in that it ignores the benefits of the activity, fails to identify any adverse effects on public health, protects all groundwater without regard to potential use, and ignores costs. (I-4(3).93, I-6(3).58, 1-6(3).52)

Response: See the response to Comment 7, A.4.2.1.

Comment 15: EPA's authority to regulate radiological and nonradiological hazards associated with uranium mill tailings derives soley from Section 275, of the Atomic Energy Act. This authority is limited to protecting public health and safety and the environment from significant risks. Since EPA has not established that: (1) Significant groundwater contamination has occurred as a result of seepage from tailings; (2) The public has been exposed to such contamination groundwater; and, (3) That such exposure may cause adverse health effects, EPA has failed to establish that a significant risk exists. Therefore, its proposed groundwater standard is illegal. (I-4(3).82)

Response: UMTRCA requires EPA to establish standards that protect the environment as well as health.

Comment 16: EPA has failed to demonstrate that groundwater has been significantly contaminated by seepage from uranium mill tailings. This view is supported by the fact that when the EPA decided to reject the option of setting uniform groundwater standards for inactive sites, it did so in recognition of the lack of data demonstrating such contamination. Also that there is not significant contamination from inactive sites is supported by the testimony of Dr. Thomas Shepherd

(F-5(H2).4), presented at the June 15, 1983, Denver, Colorado, Public Hearing on 40 CFR 192. (I-4(3).84)

Response: This rulemaking concerns standards for active uranium mills, including for the operational period when large amounts of water may be discharged to the ground via a tailings pile. The FEIS reviews existing groundwater contamination near active sites, and notes instances where corrective actions had been found necessary even before EPA proposed these standards. Dr. Shepherd's testimony indicated that under certain circumstances contamination of groundwater near inactive sites did not occur, because the water table was very deep. In other cases contamination by hazardous substances was limited. These generalities from incomplete studies of inactive sites do not justify ignoring evidence of contamination from active sites, nor the obligation to monitor the sites to determine whether significant contamination is present or might occur. Such decisions for an operating facility require standards, which, to be fairly applied, should be generally applicable. Congress directed EPA to issue standards for tailings that are consistent with EPA's standards for hazardous wastes. See the response to Comment 2, A.4.2.

Comment 17: EPA has failed to demonstrate that the public may be exposed to groundwater contamination from uranium mill tailing sites, but merely speculates on the possibility that contamination from the tailings is possible and could affect crops, animals, and people. Tailings sites are isolated from current and potential population centers, and neither the FEIS for inactive standards nor the DEIS for those proposed for active sites present any factual material showing the existence of any present exposure or likely future exposure. (I-4(3).83)

Response: See the responses to Comments 7, 15, and 16, A.4.2.1.

Comment 18: The only scientific data on which the EPA seems to be basing the proposed regulations are the elevated contaminant concentrations which the EPA claims to have observed in groundwater at seven active sites identified in the DEIS for active sites. The data relied on by EPA in the DEIS and the conclusions EPA has drawn from it are suspect. Independent studies (see Appendix V at 4-8, of I-4(2) submittal) on the data at three of these seven sites do not confirm the data accepted by the EPA. (I-4(3).85)

Response: Tables 3-2 and 3-3 of the FEIS show that hazardous constituents are present in tailings piles. Considering the high qualifications of some investigators, the number of instances of groundwater "contamination," and the theoretical reasons for believing contamination from active mills could occur, this controversy over aspects of the data does not dissuade us from concluding that seepage from piles should be regarded as a potential hazard that it is prudent to control.

!EPA Should Not Issue Design Standards!

Comment 19: EPA should modify its groundwater standard to establish protection of groundwater as the primary standard and leave design requirements to the regulatory agency. The standard should include: a leak detection system to monitor the upper most aquifer underlying the site, to provide immediate notice of liner failure and to function to recover contaminants before they contaminate the aquifer being protected; corrective action to restore degraded aquifers so sites can be released for unrestricted use; and a post-closure monitoring period to assure compliance with the standard for a reasonable period after close-out. (S-3(2).12)

Response: The requirements the commenter recommends are incorporated in the EPA's regulations for hazardous wastes. In our view, they are primariliy regulatory functions. Therefore, under UMTRCA, the regulatory agency is responsible for issuing regulations covering these functions, comparable to corresponding regulations EPA has issued for hazardous waste under the SWDA.

Comment 20. EPA should establish a standard of performance that will assure safe utilizations of groundwater resources and permit the experts in engineering to design the most cost-effective approach to meet the standard for particular site-specific conditions. I-1(2).8

Response: EPA is required to establish generally applicable standards that are consistent with EPA's standards for hazardous wastes under the SWDA. The latter standards include both design and performance requirements. Engineers have considerable, though bounded, discretion regarding site-specific methods of compliance.

Comment 21: EPA should set forth general guidance principles in its regulations, similar to the quality of use concept. Classification of use, locations of monitor wells, determination of monitoring limits, and exemptions should be left to NRC and the Agreement States. This approach would be in keeping with Congressional intent and allow the flexibility to consider site-specific conditions. (I-25.4)

Response: General guidance principles, in this instance, are no substitute for issuing generally applicable standards that are consistent with the standards EPA has issued for hazardous wastes under the SWDA, as UMTRCA requires.

Comment 22: EPA's adoption of detailed design standards developed under SWDA fails to recognize the difference between low toxicity, high volume tailings wastes and high toxicity, low volume hazardous wastes. This is contrary to Congressional intent. When EPA has completed its required study of hazards associated with mining wastes, it should issue generally applicable performance standards mandating consideration of site-specific characteristics. Design standards should be left to the regulatory authorities. (I-4(H2).14, I-1(2).16)

Response: EPA disagrees. See the responses to Comments 7 and 20, A.4.2.1. (EPA has also completed a study required by UMTRCA of the hazards of uranium mining wastes.)

!*The Standards Should Conform With State Regulations*!

Comment 23: EPA should modify its proposed standards for groundwater to include the alternative of complying with Agreement States' groundwater requirements. (I-6(3).61, I-6(H2).13, I-6(H1).20, S-3(2).10, S-3(2).11, I-30.16)

Response: See the response to Comments 7, A.4.2.1. We note further that most states do not have groundwater protection requirements.

Comment 24: EPA should not only defer primacy in regulating groundwater resources to the appropriate States (Wyoming being a prime example), but also should support classification of waters predicated on use. (I-1(2).19, I-12(2).6)

Response: See the responses to Comments 7 and 23, A.4.2.1.

Comment 25: EPA should adopt regulations similar to New Mexico's which protect groundwater at the point of reasonably foreseeable future use. This approach implicitly recognizes the complexities of the geochemical behavior of the elements of concern, the difficulties of establishing background, and the beneficial chemical reactions that occur in the subsurface. (I-6(H2).25)

Response: See the response to Comments 7 and 23, A.4.2.1.

Comment 26: EPA's proposed standards address only human hazards, and although nondegradation is envisioned this performance standard seems to become secondary to the synthetic liner standard. Wyoming's approach, where established minimum performance standards allow some degradation but protect all groundwater according to its potential uses, seems preferable to relying on synthetic liners. If a liner fails the Agency will be forced to retreat to some unacceptable level of protection. (S-3(2).7, S-3(2).9)

Response: EPA's standard is designed to protect both human health and the environment. If a liner fails, the secondary standard provides fully adequate protection of human health and the environment. Also see the response to Comment 7, A.4.2.1.

!The Standards Are Contrary To EPA's Underground Injection Program!

Comment 27: EPA's proposed nondegradation standard is contrary to the Agency's underground injection control program under the Safe Drinking Water Act. The underground injection program, which applies to in situ extraction, protects only underground sources of drinking water. Requiring conventional milling operations to protect all groundwater is arbitrary and places them at a competitive disadvantage. (I-4(3).95, I-6(3).60, I-7(2).4, I-7(2).15)

Response: UMTRCA requires the standards for uranium mill tailings to be consistent with EPA's standards for hazardous waste established under the Solid Waste Disposal Act, as amended. Consistency with requirements established for different circumstances under different authorities is not required.

Comment 28: EPA's stringent nondegradation standards are in direct conflict to the Agency's underground injection control program. (I-1(2).20)

Response: See the response to Comment 27, A.4.2.1.

!Additional Comments!

Comment 29: EPA should establish a general groundwater standard protecting existing and probable uses of groundwater against significant degradation. The standard should apply at the boundary line of the property. (I-13(2).1)

Response: See the response to Comment 7, A.4.2.1.

Comment 30: It is sufficient to question whether groundwater resources (80% of the potable water supply in the United States comes from groundwater resources) in the vicinity of a tailings pile are of sufficient quantity and quality to motivate an individual to choose to construct a home at the edge of a tailings pile. (I-1(2).40)

Response: See the response to Comment 7, A.4.2.1. EPA has determined, in effect, that an appropriate public health and environmental protection policy for groundwater renders such questions immaterial. That is, if the water is not degraded, then the presence of a nearby tailings pile needn't restrain the uses of the surrounding land.

Comment 31: EPA's nondegradation and no migration standards represent an illegal taking against the mill owners. The standards presume that the mill owner install systems requiring no future maintenance or monitoring to comply. This is beyond the authority of the Atomic Energy Act (as amended by the UMTRCA), which provides for the government to assume ownership of the land and to maintain the tailings and the groundwater influenced by the tailings. (I-7(2).11)

Response: UMTRCA is clear in requiring disposal regulations that minimize the need for future monitoring and maintenance. UMTRCA provides NRC with authority to require financial assurances from licensees to support such post-disposal functions as it (NRC) may determine are necessary.

Comment 32: In its preamble to the proposed regulations, EPA failed to explain why groundwater protection standards will not be established in a permit until after hazardous constituents have already entered the groundwater. (I-4(3).72)

Response: That is the procedure followed by the SWDA regulations. The point is that one doesn't know what substances will appear in the groundwater until they appear. The resources necessary for establishing site-specific license requirements, including determinations of background levels and consideration of exemptions and alternatives, would be wasted if they were applied to the hundreds of hazardous constituents covered by the standards for the operational period unless as is exceedingly unlikely, all the substances were actually present in the groundwater.

Comment 33: Most existing tailings ponds were designed to seep and will be unlikely to meet the drinking water standards being imposed by EPA. Since the proposed standards cannot be met, the standards are, in effect, "closure" standards--i.e., a shutdown order for existing uranium tailings operations. (I-1(2).15)

Response: The standards provide for implementing a corrective action program designed to achieve compliance (40 CFR 192.33).

Comment 34: EPA's secondary groundwater protection standards will cost hundreds of millions of dollars. The standards will force closure of many processing facilities. (I-1(2).21)

Response: See the response to Comment 8, Section A.3.3.

Comment 35: EPA's nondegradation and no-migration standards are directly contrary to New Mexico's water law. By imposing such stringent standards, EPA intrudes upon areas of law traditionally left to the States. (I-7(2).6)

Response: See the response to Comment 7, A.4.2.1. EPA is acting under a Federal law that specifically directs the Agency to establish national environmental and health protection standards for uranium mill tailings that are consistent with national standards for hazardous wastes.

Comment 36: If air emissions are evaluated according to some comparative risk analysis, it seems appropriate to evaluate any proposed water effluent standards in the same manner. (I-5(2).10)

Response: Congress provided little specific guidance regarding standards for substances emitted to air, so the Agency evaluated and considered all relevant factors. UMTRCA, however, does require consistency between standards for nonradioactive substances from tailings and standards for nonradioactive substances from hazardous waste. The latter standards relate primarily to waterborne pathways. Therefore, major aspects of water protection policies for tailings were established and implemented by EPA's rulemakings under the SWDA for hazardous wastes. We note, in addition, that it is much more difficult to quantitatively evaluate the general risks from radioactive and nonradioactive substances in groundwater than for radioactivity emissions to the air. The FEIS discusses the toxicology of such substances through waterborne pathways, but for the reasons stated above, it does not systematically compare risks under alternative levels of control.

Comment 37: The groundwater constituents to be monitored (under Appendix VIII of 40 CFR 264.99(f)) are not appropriate to the uranium milling process. Requiring analysis of these constituents is arbitrary and potentially very expensive. (I-9(2).8, I-6(3).48, I-7(2).1, I-10(2).15)

Response: According to 40 CFR 264.93(a), the standard applies only to substances that "are reasonably expected to be in or derived from waste contained in" uranium mill tailings piles. We have identified 40 CFR 264.99 as an area of regulation that NRC must address in carrying out its responsibilites under UMTRCA. EPA's concurrence is required to the effect that NRC's regulations in this area are comparable to EPA's requirements for hazardous wastes. At the appropriate time, EPA will consider whether any monitoring requirements NRC proposes for uranium mill sites are consistent with the corresponding requirements of 40 CFR 264.99. We anticipate that eliminating monitoring requirements for constituents listed in Appendix VIII that could not be related to tailings piles would be consistent with the hazardous waste requirements. However, the possibility that such constituents may be produced by chemical reactions involving nonconstituents would have to be carefully considered.

A.4.2.2 Hazardous Constituents (40 CFR 264.93)

!*Overall Comments*!

Comment 1: Many of the constituents of concern in tailings are also found at some concentration in the soils underlying the waste piles. Whether this occurs with an inactive, existing or new pile, it does not indicate that these hazardous constituents are migrating from the tailings impoundment. (I-30.14)

Response: The hazardous constituents are to be monitored in the uppermost aquifer at the point of compliance (40 CFR 264.95 and 40 CFR 264.97(a)), and not in the soils underlying tailings piles. The test of the secondary standard is whether the monitored levels exceed the previously determined background levels.

Comment 2: EPA should provide performance criteria for "nonhazardous" as well as hazardous constituents. (S-3(2).8)

Response: Analyzing water samples for the substances (non-hazardous) from tailings that are expected to be.most mobile in a given groundwater environment is a very useful feature of site-specific monitoring requirements. The regulatory agencies may establish such monitoring requirements.

Comment 3: We support adding uranium and molybdenum to the list of hazardous constituents. (P-26.18, P-22(H2).7, P-49.8)

Response: No response needed.

!*Adding Uranium and Molybdenum Is Without Basis*!

Comment 4: To categorize the uranium processing industry as hazardous waste facilities subject to the hazardous waste regulations by arbitrarily categorizing uranium and molybdenum as hazardous is analogous to begging the question. (I-1(2).14)

Response: EPA does not categorize the uranium processing industry as hazardous. EPA categorized uranium and molybdenum as hazardous for the tailings or wastes produced by the extraction or concentration of uranium or thorium from any ore processed primarily for its source material content. There are other already-categorized hazardous constituents in such tailings. EPA lists uranium and molybdenum as hazardous for UMTRCA standards only. EPA does not add uranium and molybdenum to Appendix VIII of 40 CFR 261 in this action.

Comment 5: EPA's listing of uranium as a hazardous waste before completing the Congressionally mandated report to Congress and the rulemaking procedure on the desirability of applying RCRA requirements to the uranium industry is arbitrary, capricious and unlawful. (I-20.6)

Response: UMTRCA requires EPA to set standards for nonradiological hazards from tailings which are consistent with standards for such hazards under Subtitle C of SWDA, as amended.

Comment 6: No public health basis exists for adopting nondegradation standards for uranium and molybdenum. EPA's nondegradation proposal for these constituents does not constitute reasoned rule-making. If regulation is imposed, it should be as Table 1 contituents. I-4(3).96, I-4(3).94)

Response: EPA considered the health risks from uranium and molybdenum (Appendix C, FEIS) and concludes that a sufficient basis exists to list them as hazardous constituents for purposes of UMTRCA. Uranium and molybdenum are to be controlled on a nondegradation basis similar to numerous other hazardous constituents because there is not a scientific consensus on safe concentrations.

Comment 7: Molybdenum should not be listed as a hazardous constituent. First, EPA has not demonstrated that the toxicity risk justifies imposition of standards. And second, EPA has not followed its own procedures and methodologies for listing hazardous constituents under Subtitle C of RCRA. I-18(H2).1)

Response: Molybdenum is classified as a hazardous constituent for purposes of UMTRCA only. It is not added to Appendix VIII--Hazardous Constituents of 40 CFR 216. EPA reviewed toxicity information for molybdenum and concludes there is sufficient evidence to support controlling molybdenum from uranium tailings (see Appendix C of the FEIS for Inactive Uranium Mill Tailings).

Comment 8: I am not aware of any showing of hazard of molybdenum to humans. Molybdenum, therefore, should not be added to the list of hazardous constituents. (I-27.7)

Response: See the response to Comment 7, A.4.2.2 above. Molybdenum has been shown toxic to livestock (see Appendix C of FEIS for Inactive Uranium Mill Tailings).

Comment 9: EPA's proposed nondegradation for uranium is not supported on the basis of scientific evidence. There are no radiological or chemical toxicity effects associated with levels much higher than EPA proposes, and thus there are no benefits associated with the proposed limits. (I-6(3).69, I-10(2).17)

Response: EPA's policy of nondegradation of groundwater was established after an extensive rulemaking procedure. Commenters disclosed no reason to treat tailings differently. Uranium is radioactive and radioactive contamination of groundwater is incompatible with nondegradation, apart from health risks. There is no EPA-established concentration limit for uranium in water; therefore, EPA concludes uranium should be controlled similarly to other hazardous constituents with no established limits. Also see the response to Comment 9, A.4.2.1.

Comment 10: The mere fact uranium and molybdenum have never been listed in the National Primary Drinking Water Standards provides sufficient evidence these metals have shown insufficient hazard to date to warrant regulating. (I-1(2).27)

Response: Adding uranium to groundwater is incompatible with nondegradation. Because uranium is radioactive, any exposure to uranium represents a health risk. Molybdenum may have a threshold for toxicity. However, this has not been established and EPA chooses to control molybdenum similarly to many other toxic substances for which thresholds have not been established.

Comment 11: We oppose adding uranium and molybdenum to the list of hazardous substances, as this imposes nondegradation as the governing groundwater standard for these elements. (I-9(2).3, P-6(3).8)

Response: See the response to Comment 4, A.4.2.2.

Comment 12: Since uranium levels in drinking water supplies range from 0.01-653 pCi/l, and intakes five times the ICRP 30 and 10 CFR 20 levels of 100 ug/kg are safe, uranium should not be listed as a hazardous material. (I-2(2).5, I-25.5)

Response: See the response to Comment 9, A.4.2.2.

!EPA Should Consider Other Constituents!

Comment 13: All potential hazardous contaminants in mill tailings should be specified and assessed by the Agency and, where appropriate, added to the list of hazardous constituents. (S-5.7)

Response: EPA reviewed and considered potentially hazardous constituents in uranium mill tailings (see Chapter 3 of FEIS). Monitoring requirements in the SWDA rules (40 CFR 264.97 through 264.99) provide assurance that any seepage of hazardous constituents from tailings will be found and identified. As we note in the Preamble, NRC must adopt "at least comparable" monitoring requirements for tailings sites.

Comment 14: EPA should cover sulphate and chloride, as these can degrade water to the point that it is unuseable. (P-14(H2).4)

Response: This is required of the regulatory agencies regardless of whether or not EPA sets standards, as an early warning monitoring requirement.

Comment 15: Some mention of thorium should be made as a potentially hazardous constituent of mill tailings. (F-3(2).1)

Response: Thorium is included in the consideration of hazardous constituents in tailings and in groundwater in Chapter 3 of the FEIS. Also, thorium in groundwater is limited by the gross alpha-particle activity in Table A of the UMTRCA standards.

Comment 16: Sulfates and nitrates should have been considered in determining hazardous constituents from tailings. (F-3(2).9, S-3(H2).9)

Response: See the response to Comment 14, A.4.2.2, and Appendix C of the FEIS.

A.4.2.3 Concentration Limits (40 CFR 264.94)

!Overall Comments!

Comment 1: Adoption of the specific standards embodied in 40 CFR 294.94, Table 1 is unreasonable since these standards were developed for community water systems. (I-6(3).62, I-20.4, I-23.2, I-25.2, I-19.7)

Response: The concentration limit standards in Table 1, 40 CFR 264.94 are directly from the National Interim Primary Drinking Water Regulations. These standards were selected since they assure that the action level is directly related to the protection of human health or the environment (see the Federal Register notice for the SWDA standards, 47FR32274 dated July 26, 1982). This selection is in keeping with the EPA goal of protection of groundwater quality for future uses. Also see the response to Comment 8, A.4.2.1.

Comment 2: Many of the concentration limits in Table 1 (e.g., selenium, molybdenum) are arbitrary in that they do not reflect levels required to assure that water is safe for human consumption. Indeed, the levels specified may adversely affect the public health. (I-6(3).63), I-6(3).68, I-20.4, I-6(H2).15, 1-6(3).7)

Response: Neither Table 1 of 40 CFR 264.94 nor Table A of 40 CFR 192.32 include molybdenum. EPA recognizes that a balance must be struck for these elements between what level is needed for human health and what level is toxic. Also see Appendix D, Section 4.2, of the FEIS for inactive sites (EPA 520/4-82-013-2).

Comment 3: The "gross alpha" parameter was originally intended as a screening device to detect if there were other radionuclides present. It was not intended as a regulatory device. (I-27.9)

Response: Regardless of the original intent of the gross alpha "parameter," a gross alpha maximum contaminant level of 15 pCi/liter serves to protect the environment and public health. See the response to Comment 11, A.4.2.3.

Comment 4: I recommend continuing to utilize radium-226 as the radionuclide of concern (as opposed to combining radium-226 and radium-228), since it is the one liberated in the activities under consideration. (I-27.8)

Response: EPA wishes to retain consistency with the SWDA standards, which adopted the NIPDWR values without modification as Maximum Concentration of Constituents for Groundwater Protection, Table 1, 40 CFR

264.94. Radium-228 generally will be present in tailings, though in lower amounts than radium-226. If site-specific conditions warrant, a mill operator may be granted an alternate standard under 40 CFR 264.94(b).

Comment 5: Why didn't EPA issue uranium and molybdenum water concentration limits for comment? (S-12(H2).9)

Response: At present there is no scientific consensus as to what constitutes "safe" levels of uranium and molybdenum in water.

Comment 6: Why do the regional EPA administrators have the power to establish higher concentration limits for hazardous constituents without public notice? (P-8(H1).11)

Response: These UMTRCA standards are intended to be consistent with SWDA standards for nonradiological hazards. Although the SWDA regulations require no public comment opportunity for alternate standards established by the Regional Administrator, 40 CFR 264.93(b) and 264.94(b) specify the criteria that must be used.

!*Uranium, Radium and Gross Alpha Limits*!

Comment 7: EPA should adopt A 5-10 pCi/l concentration limit for uranium, since its radiotoxicity is similar to radium. (P-30.2)

Response: See the response to Comment 5, A.4.2.3.

Comment 8: EPA's conservative risk model projects an annual risk of approximately 1.5 in a million from consuming water containing 5 pCi/l of radium. This risk is insignificant. EPA should adopt the ICRP II recommended value of 30 pCi/l. (I-6(3).66)

Response: EPA estimates the annual risk for intake of 5 pCi/l of radium-226 in drinking water to be 1.5 in 1 million. The lifetime risk is thus about 1 in 10,000, which is relatively high compared to other risks from hazardous constituents. Therefore, EPA concludes that the 5 pCi/l limit for radium-226 in drinking water should not be increased.

Comment 9: It should be noted that numerous sites around existing uranium mill tailings have natural radium-226 concentrations greater than the proposed limit. (I-27.10)

Response: 40 CFR 262.94, which is incorporated in these UMTRCA standards, requires that hazardous constituents listed in Table 1 (or Table A in these UMTRCA standards) must not be caused to exceed the concentration listed in the tables if the background level of the constituent is below the value given in the tables. If the background level of a hazardous constituent exceeds the value given in the tables, the concentration must not be caused to exceed the background level.

Comment 10: EPA's proposed concentration limits of 5 pCi/l and 15 pCi/l for radium and gross alpha, respectively, in groundwater is unreasonable when one considers that many public drinking water systems in the United States have levels in excess of 5 pCi/l. (I-5(2).7, I-6(3).64, I-20.5)

Response: EPA's nondegradation policy, as described in establishing the SWDA standards, has the goal of protecting groundwater resources for future use. As such, it has no relationship to existing concentrations of hazardous constituents in drinking water. In any case, EPA estimated when it established the radium limit in drinking water that only about 1 percent of community supplies would be affected (EPA 570/9-76-003).

Comment 11: EPA should drop the proposed 15 pCi/l gross alpha limit. After deletion of uranium and radon, this number is so low and inaccurate as to be meaningless. (S-12(H2).4)

Response: The gross alpha concentration limit is specified to assure control of alpha emitting radionuclides in water other than uranium and radon. For example, concentrations of 110 and 80 pCi/l of thorium-230 in shallow aquifers near active tailings piles have been reported. (See Table 3-4, FEIS). A limit is needed to assure control of such contamination.

A.4.2.4 Point of Compliance (40 CFR 264.95)

Comment 1: EPA's proposed point of compliance at the edge of the pond cannot be met by any existing pond or technology. Thus, EPA's proposed standards will force closure, even though no exposure occurs at the point of compliance. EPA should consider this in its assessment of cost-effectiveness. (I-4(3).86, I-4(3).88, I-4(3).99)

Response: EPA has no information that would indicate all existing tailings impoundments either presently or after corrective actions would fail to comply with the secondary standard. However, the SWDA rules, which we have adopted for uranium and thorium mills, permit establishing site-specific exemptions from and alternatives to the basic requirements of the secondary standard where to do so would pose no substantial hazard to public health or the environment. We expect many operators of existing mills to seek such alternatives. Therefore, we have established an efficient administrative procedure whereby the regulatory agencies may approve such requests from existing mills without EPA's concurrence when the basic secondary standard would be exceeded only at onsite locations closer than 500 meters from the tailings. Otherwise, EPA's concurrence with such decisions will be required. The point of compliance, however, remains at the edge of the impoundment. EPA believes that any alternative to permit contamination that would pose a substantial hazard could not be cost-effective in protecting health and the environment. Also see the response to Comment 2, A.4.2.5.

Comment 2: The point of compliance monitoring should be determined by the NRC or Agreement States based on site-specific factors. The point of compliance should be outside the site boundary at the point of current or reasonably foreseeable future use. (I-4(3).104, I-4(3).87, I-7(2).9, I-7(2).10, I-7(2).15)

Response: The point of compliance is an important element of the SWDA standards for groundwater protection. EPA established the point of compliance at the edge of the impoundment to implement the goal of the standards that there be no seepage into underlying soils or the uppermost aquifer from hazardous waste units, and to provide the earliest practical notice of any seepage that may occur. However, as discussed in the response to Comment 1, A.4.2.4, EPA is allowing alternate standards to be established based on site-specific characteristics, among other considerations.

Comment 3: The point of compliance, as identified by EPA, is the toe of the dike. Compliance at the site boundary is a more meaningful point of compliance. (I-9(2).7)

Response: See the response to Comment 2, A.4.2.4.

Comment 4: Since synthetic liners are unworkable, groundwater protection can only be achieved by alternative management techniques such as natural adsorption and dilution, collection wells, and injection wells. But these techniques cannot be employed if the point of compliance is the toe of the tailing pond. I-7(2).13)

Response: This commenter makes the assumption that all synthetic liners will fail. EPA disagrees with this assumption. Liner technology can and should be improved through proper design and quality assurance. See the responses to Comments 1 and 2, A.4.2.4.

Comment 5: EPA's proposed standards for background levels at the edge of the tailings cannot be met by existing ponds and may not be reasonable for new ponds. EPA must consider the effect dilution has on groundwater contamination. (I-11(2).6, I-10(2).15)23

Response: See the response to Comment 1, A.4.2.4 above. Dilution can be considered in issuing alternate standards under 40 CFR 264.94 (b) (1) (iii).

Comment 6: It will be impossible for most existing mines to comply with the proposed standards, and it is unrealistic in many circumstances to expect new operations to meet drinking water standards at the edge of the pond. (I-4(H2).13)

Response: EPA recognizes this potential problem and provides a possibility of relief through the issuance of alternate standards, as discussed in the responses to Comments 1 and 2, A.4.2.4.

A.4.2.5 Compliance Period (40 CFR 264.96)

Comment 1: The EPA has not put a definite time on corrective action in the pollution of groundwater. We sincerely hope that "as soon as practicable" as it relates to corrective action time limits, is definitely less than one year. (P-8(H1).18)

Response: EPA believes that corrective action should be taken as soon as practicable after it is found that groundwater standards have been exceeded. Two time limits apply for this action. Section 264.99 of 40 CFR 264 provides that a correction action plan be submitted within 180 days. Section 192.33 of these 40 CFR 192 regulations provides that a corrective action program be put into operation within 18 months at the very most. The regulation was changed to 18 months instead of a year because we agree with commenters that it may take more than one year to devise and implement an effective corrective action. The appropriate regulatory agency is responsible for seeing that corrective action is taken in a timely manner, and certainly within the 180-day and 18-month requirements.

Comment 2: EPA's one year compliance or closure rule is without redeeming value. Many repositories operated for many years before seepage occurred and it will take many more for the tailings to dry and seepage to stop. EPA's abrupt revision of current rules will cost millions, disrupt operations, and force many operations to close. (I-11(2).7)

Response: EPA has considered comments that one year may be too short a time to devise and implement effective corrective action, and has changed the regulations to require implementation of corrective action within 18 months.

EPA considered the costs of corrective actions in the FEIS (Section 7.3.3). Such costs need be incurred only where the secondary standards are not satisfied. EPA considers these costs reasonable for assuring adequate environmental and public health protection. Also see the response to Comment 1, A.4.2.4.

Comment 3: EPA's proposed corrective action time-frame of one year is unreasonable. Establishment of appropriate standards, development of appropriate actions, and conformance with State and Federal requirements makes such a time-frame unsuitable. (I-6(3).70)

Response: See the response to Comment 1, A.4.2.5.

Comment 4: Section 192.33, which provides a limit of one year for putting a corrective action program into operation is unnecessarily restrictive. (I-5(2).14)

Response: See the response to Comment 1, A.4.2.5.

Comment 5: The requirement to report in writing any level not in compliance within seven days of receipt of analysis is unreasonable. Additional time would be needed for lab analysis. (I-9(2).9)

Response: The commenter is under a misapprehension. The applicable subsections of 40 CFR 264 are 264.98(h)(1) for a groundwater detection monitoring program and 264.99(h)(2) for a groundwater compliance monitoring program. Both of these apply when there has been a statistically significant increase over the concentration limit for any hazardous constituent. The seven-day notice period begins after this determination, which in turn is made after the analyses.

Comment 6: The requirement for 30 years of post-closure monitoring is excessive. The tailings piles will dry in several years. After a water resistant cap is then installed, the potential for movement of tailings effluent into the groundwater is removed. (I-9(2).12)

Response: See the response to Comment 3, A.6.2.

Comment 7: The compliance period seems irrelevant for geographic regions where the tailings pile may never dry out. (P-8(H1).4)

Response: The tailings needn't "dry-out;" the "free liquids" must be removed, by mechanical means if necessary. The closure standards require a low permeability cap to be placed over the tailings to keep water from penetrating through to the ground. Other protective actions may be employed, based on any needs that are determined from monitoring during the compliance period.

A.4.2.6 Corrective Action Programs

Comment 1: EPA should specify the consequences of noncompliance. (P-1(H2-2).6)

Response: Penalties for non-compliance are established by law (See UMTRCA - P.L. 95-604, Sec. 205).

Comment 2: We generally support EPA's proposed primary and secondary groundwater standards, but suggest the secondary standard be improved by requiring a liner *in-situ* or removal to below grade trenches if a licensee fails for two consecutive years to comply with the proposed hazardous concentration limits in seepage fluids. For sites with known seepage problems, EPA should require immediate cessation of tailings deposition and implementation as soon as possible, of the proposed 192.33 compliance program. (P-1(2).8, P-1(2).25, P-30.8, P-1(H2).9, P-1(2).41, P-26.17, P-30.2, P-13(2).5, P-13(2).10, P-1(2).53, P-1(2).53, P-1(H2-1).10, P-1(2).40, P-26.16)

Response: Corrective actions can take a number of different forms and can also be highly dependent on specific site characteristics. The regulatory agencies have the responsibility to approve corrective actions and must include specific measures to be taken and time periods in the license. 40 CFR 264.100 also specifies the period over which corrective actions must continue after closure if they are being conducted at the time of closure. EPA believes any corrective actions undertaken should have a reasonably high probability of success, but administration of the corrective actions is a regulatory function.

Comment 3: EPA should prohibit additional depositions at existing sites after one year of noncompliance with the hazardous concentration limits during the operation of a noncompliance program. (P-26.16)

Response: EPA was faced with a trade-off regarding continued use of existing piles versus construction and use of new lined impoundments in the groundwater protection question. New impoundments would contaminate more land area and release more radon, but would probably cause less groundwater contamination, once the old pile dried out. On balance, EPA believes continued use of existing piles minimizes health risks and environmental contamination. See the response to Comment 3, A.4.2.6.

Comment 4: EPA should clarify its prohibition on additional dispositions to limit the prohibition to the leaking impoundment, not all impoundments at the facility. (I-10(2).25)

Response: Regulatory agencies are responsible for approving corrective actions and making them part of a mill's license. Therefore, the regulatory agencies must decide which impoundments may be operated and which must terminate use. The purpose of EPA's standards are to protect or restore water quality, using whatever means the regulatory agencies may approve.

A.4.3 Surface Water Protection (40 CFR 440)

!*Standards are Unlawful, Unnecessary, or Excessive*!

Comment 1: We oppose EPA's application of Clean Water Act standards to uranium mills. EPA's proposed application of Clean Water Act standards to uranium mills is unlawful since EPA lacks jurisdiction under the act to regulate source and by-product materials. If EPA wants to propose surface water effluent standards, it must devise such standards under Section 275 of the Atomic Energy Act and propose them for comment. (I-6(3).78, I-6(3).12)

Response: UMTRCA extends EPA's jurisdiction under the Atomic Energy Act to mill tailings as byproduct material. EPA is required by UMTRCA to protect health and the environment from adverse effects from mill tailings by all routes, including surface water. EPA has decided that the existing provisions of 40 CFR 440, Subpart C (Uranium, Radium, and Vanaium Ores) provide adequate protection for surface water.

Comment 2: Existing standards for protection of surface water under 10 CFR 20 Appendix B, are adequate to protect public health. (I-6(3).79)

Response: EPA does not agree. The standards of 10 CFR 20, Appendix B, correspond to the basic Radiation Protection Guide of 500 mrem/yr to individuals in the general public. It is generally recognized that this level is a ceiling, and that radiation doses should be maintained as far below this standard as is reasonably practical. See also response to Comment 5, A.4.5.

Comment 3: We agree that no additional standards for surface water are needed under UMTRCA. (I-11(2).4)

Response: No response required.

Comment 4: EPA's regulation prohibiting discharge of process waste water from mills does not merely prohibit contamination, it also prohibits discharge of water treated to the extent that a receiving stream would benefit by a discharge. (I-15.8)

Response: These regulations are contained in 10 CFR 440, Subpart C, which was promulgated on December 3, 1982 (Federal Register, Vol. 47, p. 54598-54621). The preamble to that rule presents (p. 54603) the reasoning behind the requirement for zero discharge for new uranium mills. Also see the response to Comment 7, A.4.3.

Comment 5: Contrary to ICRP protection criteria, EPA insists on overprotecting some hypothetical users by arbitrarily imposing very restrictive and costly standards that were never originally designed to be applied to industrial settings. I-1(2).28

Response: ICRP protection standards and criteria are similar to those issued by the Federal Radiation Council in 1960 (Federal Radiation Council "Background Material for the Development of Radiation Protection Standards," May 13, 1960. ICRP recognizes these levels as ceilings, and recommends that radiation doses be kept below these levels as much as practicable. See also the response to Comment 5, A.4.5.

Comment 6: Flood control should be required over the same length of time as the longevity requirement. (P-49.6)

Response: Flood control is included in the longevity requirement. The FEIS in discussing longevity, says that of all natural processes "floods are probably the greatest hazard to integrity." (Section 8.2.3). This section of the FEIS discusses how the longevity requirements and the recurrence time of floods at a site combine to affect design requirements.

Comment 7: EPA's regulations prohibit discharge of water treated to the extent that a receiving stream would benefit by a discharge. In net precipitation states, where seepage is also prohibited, how does one remove the waste water? (I-15(2).7)

Response: The response to Comment 5, this section, applies also to the first part of this comment. The second part of this comment refers to new mills, since there are no mills currently operating in non-arid areas. Subsection 440.34(b)(1), which given New Source Performance Standards, provides for discharges from mills to the extent that precipitation and runoff exceed evaporation.

!*Standards Are Inappropriate For Net Precipitation Areas*!

Comment 8: EPA's enforcement of surface water protection through the Clean Water Act allows for loopholes in net precipitation areas. The concentration of tailings pile effluent constituents allowed in net precipitation areas are unacceptably high. (P-5(H1).9, P-5(8).2, P-5(H1).12)

Response: EPA's New Source Performance Standard for uranium mills (40 CFR 440.34(b)) prohibits discharge of liquid effluent to surface water, except for mills in areas where the rainfall exceeds evaporation. In such net precipitation areas, the allowed discharge is subject to volume and concentration limits given in Part 440.34(a). EPA believes they are adequate.

Comment 9: By ignoring non-arid areas and failing to set concentration limits for surface water discharges in the regulations, EPA has placed a great regulatory burden on net precipitation states. (P-5(H1).16)

Response: The commenter is incorrect in stating the EPA has failed to consider non-arid areas and to set concentration limits for surface water discharges. Concentration limits for existing mills are given in Subsection 440.32(b) of 40 CFR 440. All existing mills are in arid regions and only one of these discharges waste water (Federal Register, Vol. 47, p. 54603). Regulations for new sources in subparagraph 440.34(b)(1) provide for discharges to the extent that precipitation and runoff exceed evaporation, and provide concentration limits for any such discharges.

!*Additional Comments*!

Comment 10: Surface water standards should include the possibility of flooding. (P-8(H1).15, F-1.4)

Response: Flooding of an operating mill has many site-specific engineering and operational implications. We believe the regulatory agencies' licensing process is the best place to deal with operational period flood protection specifications. Also see the response to Comment 6, A.4.3.

Comment 11: Seepage from tailings disposal areas has generally been shown to be nondetrimental. However, if the tailings ponds are lined to prevent seepage, there will be many sites which have a discharge. Thus, surface water quality will become a greater concern. (I-27.4)

Response: The Agency believes that uranium mills in the arid or semi-arid areas where U.S. milling occurs can use evaporation, recycle, or both to make discharge to surface water unnecessary. This problem was considered in the rulemaking process for 40 CFR 440 and is briefly summarized on p. 54603 of volume 47 of the Federal Register, December 3, 1982. Also see the response to Comment 9, A.4.3.

A.4.4 Control of Radon Releases (during operations)

!Controls of Radon Release Are Inadequate!

Comment 1: The radon emission standards are unacceptably high and threaten the public health. (P-5(H1).13, P-8(H1).20, P-8(H1).7, P-1(2).33)

Response: Based on currently available evidence, EPA believes that regulating individual mills so as to keep their emissions "as low as reasonably achievable" within the numerical Federal Radiation Protection Guides is the best regulatory approach to limiting such releases. However, we are asking for public comments on whether work practice standards issued under the Clean Air Act are needed and would be a reasonable means to further limit such emissions.

Comment 2: Why are there no limits on permissible radon releases from tailings being pumped into the pond or while they are supposedly drying? (P-8(H1).6)

Response: There are no significant releases of radon from tailings in a slurry while it is being pumped into the pond. There are no limits on radon releases while tailings are drying out because there is no practical control that will also permit the tailings to dry. The small health detriment arising from radon emissions while tailings are drying out is more than compensated for by this process, which makes it possible to stabilize the tailings for many centuries.

Comment 3: Radon concentrations should be limited to 0.3 pCi/l at the site boundary. But we do not support allowing mills to achieve this concentration by acquiring additional land. Compliance should be achieved by reducing emanations from the pile. (e.g., Require below grade disposal of new tailings) (P-1(2).29, P-1(2).31)

Response: EPA did not establish a concentration limit at the site boundary for reasons detailed in the Preamble of the standards.

Comment 4: Radon control during operations could be achieved by requiring thin soil cover or various fixitants to portions of the tailings that are drying out. (P-26.23)

Response: We do not believe such methods will achieve control of radon. Rather, they prevent spreading through wind erosion.

Comment 5: EPA should limit the total surface area not under cover (i.e., final disposal) to limit radon emissions. (P-45.8)

Response: See the response to Comment 3, A.4.4.

Comment 6: No radon releases above background should be allowed. Dewatering should be done in enclosed facilities equipped with radon collection systems. (P-3(2).2)

Response: Such a system would be prohibitively expensive and provide only a small health benefit. See the response to Comment 2, A.4.4.

Comment 7: EPA should explicitly incorporate ALARA into the radon control requirements. (F-3(2).24)

Response: We have done so.

Comment 8: Your continuation of the ALARA principle for the milling operation period is of concern to us. (P-5(H1).6)

Response: See the response to Comment 1, A.4.4.

Comment 9: EPA should clarify its intent of how ALARA should supplement the radon emission standard of 10 CFR 20. (S-3(2).5)

Response: The application of ALARA is well-established in NRC licensing procedures. EPA's intent is that NRC should require all practicable methods for minimizing radon emissions. These will vary from site to site, from time to time, and for old versus new tailings. EPA will, in addition to its consideration of this matter under the Clean Air Act (see Comment 1), maintain cognizance of the NRC and Agreement State implementation of the ALARA requirement.

!Control Of Radon Releases Is Not Required And Impractical!

Comment 10: We agree with EPA's decision to retain the radon/radon decay product release limits in 10 CFR 20, Appendix B, during the operational period. Coupled with the NRC's ALARA requirement, they provide ample protection. (F-2.2, F-3(2).20, I-6(3).2, I-6(3).37, I-11(2).3, P-9(H1).1, P-9(H1).13, S-12(H2).2, F-3(2).11, F-6(2).12, F-5(3).9)

Response: EPA has required that exposures be maintained As Low As Reasonably Achievable below the upper limits specified in 10 CFR 20. Operation at 10 CFR 20 levels on a continuous basis would not constitute compliance with this requirement of the standard, unless that level of operation is shown to be ALARA.

Comment 11: Even if EPA's excessive radon risk estimates are accepted, they do not reflect a level of significant risk that would warrant control. (I-6(3).35, I-6(3).36)

Response: We do not agree. We estimate the lifetime risk for maximum exposed individuals is about 2 in 100 and we project total national population impacts of five cancer deaths per pile per year. These risk estimates are confirmed by our review for the FEIS.

Comment 12: There are no reasonably available controls or work practices available to reduce radon emissions from operating uranium mills. Disposal in trenches is generally not feasible at existing locations due to costs and local geology. Mills in New Mexico proposing such a system have never been constructed or operated because of the high costs. Controlling radon concentrations by extending site boundaries is not feasible since mills do not have the power of eminent domain and many land interests are simply not available. Further decreases in radon levels, below 10 CFR 20 limits should be achieved on a case-by-case basis through ALARA. Any such standards would cause higher prices and/or plant closings without demonstrable benefit. (I-6(3).38, I-6(3).41, I-6(3).40, I-6(4).12)

Response: The comment is incorrect. Disposal in trenches is feasible at many sites and existing piles can be kept wet. We agree ALARA should be practiced on a case-by-case basis, at least as an interim measure.

Comment 13: We oppose incorporation of a guidance into regulations that will numerically limit to 1 pCi/l the radon concentration to which real individuals in the proximity of tailings ponds are exposed. EPA's proposal to incorporate guidance into regulations will again place the burden of proof on industry. (I-1(2).30)

Response: Federal guides are already in effect, since they govern NRC's regulations. The burden of proof that radiation standards are being complied with is traditionally and properly the responsibility of the licensee.

Comment 14: Industry currently complies with the radon concentration limits of 3 pCi/l as well as the philosophy of maintaining effluent releases ALARA. Beyond the retrofitting that has already occurred, additional engineering design features to further control radon emissions are not justified both in potential costs and nominal projected health effects. (I-1(2).31)

Response: EPA agrees that if releases are, in fact, shown to be ALARA, there will be no need to add any new engineering design features to further control operational releases of radon. Controls needed to comply will have to be determined on a site-by-site basis.

A.4.5 Dose Limits Other Than Radon Emissions (40 CFR 190)

!40 CFR 190 Limits Are Too Stringent!

Comment 1: The cost of complying with the 25 mrem limits of 40 CFR 190 are greater than one million dollars per mill. Since there are no demonstrated health effects at this low level, the costs are clearly unreasonable. Even if EPA's unsupported linear nonthreshold model is accepted, the approximately five billion dollars required to avert one potential health effect is unwarranted.

Response: Failure to demonstrate adverse health effects does not mean that there are no such effects. The epidemiological studies that would demonstrate these effects are inadequate to either prove or disprove the hypothesis that there are adverse health effects. Numerous reports have reviewed the basic requirements of epidemiological studies of background radiation. They require a base of millions to hundreds of millions of person years of data to detect the incremental increase in risk projected by current risk coefficients, even for exposure levels around four times average background. Such data bases do not exist for any areas near facilities regulated by 40 CFR 190.

The costs of controlling operational nonradon emissions from the model tailings pile are given in Table 7-2 of the FEIS. We consider these costs, which also serve to reduce radon emissions to be reasonable. The cost-effectiveness of these limits was considered in the rulemaking for 40 CFR 190.

Comment 2: We do not support EPA's proposal to continue to apply 40 CFR 190 to uranium mills. (I-6(3).11)

Response: EPA disagrees. See the response to Comment 1, A.4.5.

Comment 3: 40 CFR 190 should be dropped. After two years of expensive monitoring, we can distinguish no significant doses to the public. (I-11(2).2)

Response: EPA notes that the comment implies that the site is apparently in compliance with 40 CFR 190. Also see the response to Comment 1, A.4.5.

Comment 4: The dose limits were arbitrarily chosen and based primarily on the number of companies that could achieve compliance rather on the number of projected health effects which were conservatively overestimated. (I-1(2).29)

Response: The dose limits of 40 CFR 190, which have been applicable to uranium tailings piles, were not based on the number of companies that could achieve compliance. They were based on a cost-effective balance between reduction of risk and the cost of controls. We believe these limits are reasonable for controlling windblown erosion from tailings piles, without excessive cost to the industry.

Comment 5: 40 CFR 190 dose requirements are totally unrealistic and should not apply to uranium mills. The internationally recognized standard of 500 mrem (100 mrem to sizeable populations) is much more reasonable. (I-28.3, I-28.9)

Response: The Radiation Protection Guide of 500 mrem/yr for individuals in the general population has always been recognized as a ceiling. The Federal Radiation Council, in establishing this Guide, and the associated Guide of 170 mrem/yr for the average of population groups, said (FRC 60): "Every reasonable effort should be made to keep exposures as far below this level as practicable." Similar guidance by NCRP and ICRP have always made equivalent statements. The applicability of lower standards to specific situations has been recognized by the NRC, in Appendix I to 10 CFR 50, regulating radiation from releases from lightwater nuclear power plants.

(FRC 60): Federal Radiation Council, 1960, "Background Material for the Development of Radiation Protection Standards," (May 13, 1960), paragraphs 5.3 and 5.4.

!*40 CFR 190 Limits Are Too Lax*!

Comment 6: 40 CFR 190 standards for particulates are inadequate to protect people from wind-borne particulates. Further, it is a virtually unenforceable dose standard and should be replaced with a zero emission standard. (P-3(2).1, P-49.11)

Response: We believe the 40 CFR 190 standards, which are already in effect for uranium mill tailings, are adequate to protect people. This question was considered in the 40 CFR 190 rulemaking and is documented in the FEIS and FR notice for 40 CFR 190. NRC, as the appropriate regulatory agency, has been enforcing 40 CFR 190 by well-established methods of determining the source term and its dispersion, and by appropriate field monitoring.

Comment 7: 40 CFR 190 is inadequate because it does not limit gamma exposure, and gamma exposure from windblown tailings could exceed 500 mrem. (P-45.24)

Response: The commenter is incorrect. 40 CFR does include gamma radiation, and a gamma exposure of 500 mrem/yr from windblown tailings would violate the standards.

Comment 8: 40 CFR 190 is inadequate because it does not limit radon and its daughters. Control of tailings dust should be an integral part of the standard. (S-3(2).3)

Response: The commenter is correct in saying that 40 CFR 190 does not limit emission of radon and its short-lived daughters. We have in this (UMTRCA) regulation required that the regulatory agency make every effort to keep radiation doses from radon emissions from tailings as low as is practicable, and in any case less than the Federal Radiation Protection Guide.

We concur with the commenter that control of tailings dust should be an integral part of the standard. We have reaffirmed the applicability of 40 CFR 190 in the UMTRCA standard.

Comment 9: EPA should propose the same 10 mrem standard, proposed April 6, 1983, to all industries that emit radionuclides. (S-3(2).4)

Response: EPA's proposed regulation for radionuclides emitted to air, referenced by the commenter, did not apply a dose limit of 10 mrem/yr to all industries. That standard was proposed only for DOE facilities, for NRC-licensed facilities not in the uranium fuel cycle, and to other (non-DOE) Federal facilities. EPA based the proposed 10 mrem limit on studies of the characteristics of these specific radiation sources. The analyses we made earlier for the 40 CFR 190 rulemaking supported a dose limit of 25 mrem/yr for uranium mill tailings, and we believe this standard is reasonable.

A.5.0 STANDARDS FOR DISPOSAL

!The Standards Are Too Lax!

Comment 1: EPA's rejection of the nondegradation alternatives (for disposal standards) (48 FR Section V. p.19596, Column 3, first paragraph) is inconsistent with EPA's reasoning and requirements for nondegradation of groundwater. (F-3(2).16)

Response: We believe our reasoning is consistent. The standards must consider several hazard pathways, as described in the Preamble and EIS, both during operations and after closure. For all pathways, we have attempted to identify the lowest reasonably achievable environmental and health risk when all relevant factors are considered, including applicable legal constraints. This process, consistently applied to all the pathways, has led to standards that differ in the stated degree of control among the various pathways.

Comment 2: EPA's preferred Alternative D will not meet the Congressional mandate under UMTRCA. The chosen option (200-year performance) does not provide basic protection from all pathways, namely, radon, airborne particulates, misuse of tailings, and groundwater protection. (P-4(H1).7, P-15(H2).4, P-22(H2).2, P-35.2, P-30.4, P-34.1, P-35.1, P-36.1, P-41.4)

Response: EPA has retained the 200-year longevity minimum, for reasons described in the Preamble.

Comment 3: Even alternative F falls woefully short of assuring the isolation of these wastes and protection of groundwater for the millenia these wastes will remain hazardous. (P-33.6)

Response: The standard affords protection that is reasonably assured to be highly effective for at least 200 years, and should be partially effective for thousands of years thereafter. We know of no practical way to assure full protection for the much longer periods the wastes may continue to pose some hazard to people or the environment.

Comment 4: The Draft Environmental Impact Statement clearly indicates a preference for Option E over that ultimately chosen by the Agency. (P-4(H1).5)

Response: EPA disagrees. Our reasons are discussed in the Preamble and the RIA.

Comment 5: We support Alternative F for governing tailings disposal, since these standards will provide the greatest protection at the most reasonable cost. (P-1(2).3, P-41.4, P-35.8, P-49.1, P-60.2)

Response: EPA disagrees. Our reasons are discussed in the Preamble and the RIA.

Comment 6: Alternative F would accomplish the ALARA goal of reducing radiation exposure from mill tailings. (P-1(2).9)

Response: After careful re-consideration, we believe the radon release requirement of Alternative F is impractical, for reasons that are fully stated in the RIA and the Preamble.

!*Basis for the Standard*!

Comment 7: In developing a standard for disposal of tailings, the following groundrules should be adopted:

a. Tailings should be stabilized to prevent dispersal;

b. Disruption of stabilized tailings by man-made and natural forces should be minimized;

c. Institutional controls are essential;

d. Occupied structures should not be built within a half-mile of the reclaimed tailings;

e. Reclaimed tailings should be considered dedicated land;

f. Stabilization of medium and low priority inactive mill sites should be evaluated on a site-specific basis; and

g. 10 CFR 20 should be used as a prime performance standard.

(P-20(H2).1)

Response: EPA agrees with points a., b., and c. Points d through g require a high degree of institutional control, however, which EPA has found to be neither necessary nor prudent, and inconsistent with Congress' intentions under UMTRCA. Physical control systems needed to satisfy points a. and b. and a radon emission requirement, as under EPA's is standard, minimize the need for long-term institutional controls.

Comment 8: Given our inability to assure control over long time periods, EPA should set the minimum standards which assure control and revisit the problem regularly. (P-9(H1).6, P-4(H1).12, S-1.4)

Response: EPA is authorized to reconsider the standards whenever it seems advantageous to do so. Under the final disposals standards we are establishing, however, we do not anticipate revisions will be needed. The routine conduct of our radiation program responsibilities will assure that we maintain an adequate level of awareness of how well the standards are working. Also see the response to Comment 7, A.5.0.

Comment 9: We oppose application of 40 CFR 264.111 to uranium mills to the extent that it will require cover systems designed for wet areas to be applied in arid areas. Cover designs should be determined by the licensing agency to permit cost effective designs to be used. (I-6(3).46)

Response: 40 CFR 264.111 represents a value judgment that applies equally well to wet and dry areas. The licensing agency has considerable discretion regarding methods for complying with this requirement.

Comment 10: The Agency should consider additional disposal alternatives at existing mills, such as new disposal facilities which would handle some fraction of existing tailings. (P-4(H1).17)

Response: Provided existing tailings comply with the standards, we believe it is self-evident that requiring the tailings to be moved to a new facility would not be a cost-effective means of accomplishing our health and environmental protection goals. The SWDA standards, with which we must be consistent in the absence of specific circumstances that justify differences, do not have such a requirement. We know of no differences between tailings and the hazardous wastes covered by the SWDA rules that would justify imposing the requirement for tailings.

Comment 11: EPA mistakenly assumes that UMTRCA prohibits EPA from considering a package of active and passive controls to stabilize tailings. The final version added the word "minimized" so that 42 U.S.C. Section 2201(X)(2)(Supp.V 1981) reads "need for long term maintenance and monitoring of such site ...will be minimized and, to the extent practicable, eliminated." (I-4(3).64)

Response: EPA has made no such assumption. We believe we have fully complied with the quoted passage from UMTRCA, and with other indications of Congress' intentions regarding active and passive controls.

Comment 12: The standard should only require reasonable controls to protect against erosion and dispersion for a reasonable period of time, coupled with Government ownership. This would assure reasonable protection for the public and the environment. (I-6(H2).31)

Response: EPA considered a range of alternatives, including the one suggested. EPA's final standard provides much greater health and environmental protection benefits with a far lesser reliance on future institutional functions. We believe EPA's standard complies with Congress' intention under UMTRCA to apply long-lasting passive control measures if EPA, having examined all relevant factors, finds it reasonable to do so. Our analysis shows that standards that provide effective, long-lasting protection against erosion, dispersion, misuse, radon emissions, and water pollution are technically feasible and economically practical. We see no reason to adopt the commenter's suggestion, which would provide inadequate protection at a higher cost in relation to the benefits obtained.

Comment 13: Although EPA's proposed regulation sets different standards for the control of radiological and non-radiological hazards, the Preamble addresses only the types of control measures that EPA thinks would satisfy its radiological hazard standards. The implication is that the two to three meter thick cap that will be required to bring radiological hazards within their proposed standard would also satisfy the nonradiological hazard standard. (I-4(3).73)

Response: See the response to Comment 50, A.5.0.

Comment 14: If EPA retains its current longevity requirement (200-1,000 years) and adopts the suggested risk-based environmental standard (0.3 pCi/l) for radon, NRC would implement using a three-tiered system, as follows:

a. Design a 1,000 year stability standard in terms of erosion control and prevention of misuse and intrusion.

b. Include design features to meet the radon standard.

c. Apply ALARA on a site-specific basis.

(F-6(2).11)

Response: EPA has retained the minimum 200 year and up to 1000 year control requirement. We have also retained a radon flux limit rather than adopt the suggested concentration standard. Nevertheless, NRC's suggestion of a three-tiered approach to satisfying the final longevity and radon emission requirements should be workable. We believe, however, that reversing the order of steps (a) and (b) would be more efficient.

!Standards Should Include!

Comment 15: EPA's standards should include a siting criterion for an isolation distance between the disposal site and any floodplain through which a stream is likely to cut. (P-45.30)

Response: Deciding the means of complying with EPA's standard is a regulatory function. NRC and its Agreement States may adopt whatever regulations they determine are necessary to satisfy the longevity requirement.

Comment 16: We support a siting standard to protect against the effects of a probable maximum flood. (P-1(2).51)

Response: See the response to Comment 15, A.5.0. In the Preamble and the EIS, we discuss the relevance of flood protection specifications to compliance with the longevity requirement.

Comment 17: EPA's reliance on purely passive measures is a mistake. Active mechanisms must be in place to take corrective action, if necessary. (I-4(3).66, I-4(3).66, I-4(3).68, I-10(2).12)

Response: EPA does not rely entirely on passive measures. UMTRCA provides NRC with adequate authority to take corrective action if the need arises. Congress clearly intended to minimize the need for such actions, however. See the response to Comment 11, A.5.0.

Comment 18: We support active control measures in the early years to assure that long-term stabilization measures and passive controls will be effective far into the future. (F-3(2).22, I-4(H2).15, S-12(H2).13)

Response: EPA agrees, in the sense expressed in the response to Comment 17, above. The disposal system should from the outset be designed for long-term effectiveness, as EPA's standard requires.

Comment 19: The 200-year standard implies passive management of the tailings pile. The expectation of the EPA to engineer a system requiring no maintenance for in excess of 200 years is unreasonable when New Mexico has already made provisions to perform ongoing maintenance activities, and the mill operators have already contributed a maintenance fund. (I-9(2).11)

Response: EPA recognizes that a tailings pile may need maintenance, and believes it prudent to provide for any needed maintenance, as UMTRCA and New Mexico have done. The EPA standard, however, requires disposal systems to be designed to last for the longevity period. Significant maintenance should be needed only if the system fails to perform as designed. See the response to Comment 17, A.5.0.

Comment 20: We do not believe that institutional controls are adequate to protect public health and safety from immediate hazards, to say nothing of the hazard identified by the Agency for hundreds of thousands of years. (P-4(H1).12, S-1.4)

Response: EPA believes it is prudent and sensible not to rely on institutional controls when adequate physical control methods are available and practical to apply. We rely on institutional controls when alternatives are not reasonably available, such as to prevent inappropriate development of the tailings disposal site. We have not identified any practical control method for tailings, physical or institutional, that we could expect to be effective for hundreds of thousands of years.

Comment 21: The Agency should redraft the regulation to unambiguously mandate that, to the maximum extent practicable, long term maintenance and monitoring of tailings be eliminated. (S-15.13)

Response: The Preamble and final standard combined make EPA's intentions adequately clear that the standard applies to the design of the disposal system, and cannot be satisfied by institutional arrangements alone. See the response to Comment 19, A.5.0.

Comment 22: Institutional controls are not feasible for long-term or even for short-term protection. (S-1.5, S-12(H2).13, P-26.3, P-33.10, P-34.2)

Response: No response is required.

Comment 23: EPA should consider the government ownership stipulated by UMTRCA in evaluating the controls needed to prevent intrusion, misuse and dispersal by people. (F-6(2).15)

Response: EPA did consider Congress' intention in providing for government ownership of the site. We believe the language and legislative history of UMTRCA clearly indicate its intent is to supplement adequate long-term physical controls with institutionally-based protection mechanisms. For example, Section 161(x) of the Atomic Energy Act, as amended by Section 203 of UMTRCA, requires mill site decommissioning to minimize, and, to the maximum extent practicable, eliminate the need for long term maintenance and monitoring. Nothwithstanding this requirement, the next paragraph authorizes NRC to secure financial arrangements from licensees to assure funding for any long term maintenance and monitoring NRC determines is necessary. Furthermore, House Report 95-1480, Part I, states that the custodian of the disposal site should treat the tailings "...in accordance with the substantial hazard they will present until long after our existing insitutions can be expected to last in their present forms." With respect to inactive sites, Part II of the House Report warns against "...using technology that may be effective for a short period of time." "The remedial action must be done right the first time," it stated.

!Probability Of Misuse Is Over-estimated Or The Solution Is Inappropriate!

Comment 24: EPA does not justify its proposed tailings cover requirement. The chance of future misuse of tailings is remote, particularly in light of the requirement for the government to own stabilized tailings and to monitor them in perpetuity. (I-6(H2).8, I-23.4, I-25.20, I-25.21)

Response: See the response to Comment 23, A.5.0.

Comment 25: The best approach to discourage misuse of tailings is to retain the tailings site under Federal or State control, noting appropriate land records and periodic surveillance to detect any encroachments. (F-1.6, F-5(3).3)

Response: See the response to Comment 23, A.5.0.

Comment 26: EPA's proposed cover requirement will not necessarily prevent misuse and ignores cost effective measures, such as notations on land title records, as a means of alerting society that some hazards may be associated with certain uses of the property. (I-4(3).15, I-7(2).16)

Response: EPA's cover requirement is intended, among other benefits, to inhibit misuse; we agree that the standard will not necessarily prevent misuse. See the response to Comment 23, A.5.0.

Comment 27: EPA has failed to provide any analysis of the probability of misuse for alternative cover thicknesses to support its characterization of thick covers as effective. Moveover, the probabilities of misuse it assigns to various covers are inconsistent with the probabilities used in the FEIS on inactive sites. (I-4(3).11)

Response: It is not possible to determine probabilities of misuse especially over long periods. EPA discusses this in the DEIS (page 8-9) and the FEIS (page 8-12). EPA considered it sensible to list the relative protection different thicknesses of earth would provide for this important benefit. The probabilities of misuse (chance of misuse) are listed in qualitative terms which differ slightly between the inactive FEIS and the active DEIS. However, the relative ratings are consistent between the two, i.e., a cover that meets 20 pCi/m^2-sec provides more protection against intrusion than a cover that meets 60 or 100 pCi/m^2-sec.

Comment 28: Active maintenance of tailings piles cannot necessarily prevent misuse. However, active maintenance can effectively restrict the degree of misuse. (I-1(2).33)

Response: EPA agrees, so long as maintenance and surveillance are applied. However, we believe the proper role of such institutional controls are as supplements to adequate physical barriers to misuse. We believe the effectiveness of the physical barriers over long-time periods is more predictable than the effectiveness of institutional controls. Also see Comment 23, A.5.0.

Comment 29: Any hypothetical scenarios wherein current institutions fail have the same probability of protection as they lack protection; to deem otherwise, as EPA is alluding to, merely evokes phobic responses to such sensationalism. (I-1(2).34)

Response: The point is rather that the long-term effectiveness of physical methods is more predictable. We cannot predict the future implementation of institutional arrangements; numerous examples of both effective and ineffective long-term institutional arrangements could readily be cited. UMTRCA clearly requires that reliance on maintenance and monitoring be minimized. We have found that meeting this requirement is feasible and practical.

Comment 30: The fundamental institutional control is governmental ownership of the disposal sites, which requires no activity on the part of the government and, in EPA's own view, is sufficient to prevent such misuse as building habitable structures on the sites. (I-7(2).24

Response: See the responses to Comments 20, 23, 28, and 29, A.5.0.

Comment 31: EPA states that institutional controls are "essential," though, in the Agency's view, primary reliance cannot be placed upon them. EPA should note that the fundamental institutional control is that of governmental ownership of disposal sites, which should be effective in preventing misuse. (I-7(2).22, I-30.5)

Response: See the responses to Comments 20, 23, 28, and 29, A.5.0.

Comment 32: EPA fails to note that the Agency has assessed the extent of misuse near inactive mills and has found that, with the exception of a very small site in Idaho, misuse has actually occurred only at a few sites located in the vicinity of population centers. Such use occurred during a time when there was little recognition of the hazards presented by these tailings. (I-7(2).20)

Response: EPA agrees that widespread tailings misuse occurred before the hazard was appreciated. EPA staff continue to receive anecdotal reports, however, of small-scale misuse of mining and milling wastes. Contrary to the commenter's impression, Table 3-6 of the FEIS for Remedial Action Standards for Inactive Uranium Processing Sites (EPA 520/4-82-013-1) notes evidence that tailings have been found in several communities near mills in low population areas. In many instances, tailings have been transported 10-15 miles to their point of use.

Comment 33: The failure of institutional controls is highly unlikely and will occur only if the government determines at some time in the future that the controls mandated by the UMTRCA are unnecessary. Guarding against such a determination is not within EPA's authority under UMTRCA. In effect, EPA is claiming authority to protect against a change in standards by the government itself, contrary to existing law, and would impose the cost of such protection on private parties - clearly an unconstitutional taking without just compensation. (I-7(2).18, I-7(2).25)

Response: EPA has been guided by the language and legislative history of UMTRCA, which contradicts the commenter's interpretation. Congress clearly intended long-term control measures to be applied, so as to minimize reliance on government. The House Report itself noted that institutional controls could not be expected to remain effective for the very long periods the hazard would persist. EPA has set standards based on the best currently available information. UMTRCA authorizes EPA to revise these standards at any time. We cannot now determine whether any such future revisions would be in the direction of loosening or of strengthening the standards. Therefore, the commenter's remarks are not only speculative, but express only a single side of the speculations that might be made. Also see the response to Comment 23, A.5.0.

Comment 34: EPA gives insufficient weight to the lessons learned from the Grand Junction incident and minimizes the long term control by Federal or state governments after operations have ceased. (I-22.3)

Response: EPA disagrees. The standard in no way limits using any additional institutional controls Federal or state governments may find are needed for health or environmental protection purposes. UMTRCA authorizes such actions. EPA is merely supporting UMTRCA's directive to minimize reliance on such controls. See the responses to Comments 23, 28, 29, and 32.

Comment 35: The only property of tailings making them attractive for construction purposes is that the material is a homogeneous sand of convenient particle size distribution. Other sandy materials would serve equally well; there is nothing unique about uranium mill tailings for such an application. Therefore, in order for such misuse to occur, it is not sufficient that the tailings be accessible; rather, they must be more conveniently accessible than alternate materials which can serve the same purpose. (I-10(2).7, I-7(2).19)

Response: An extensive survey conducted for EPA in 1972 found thousands of locations where tailings had been used for many purposes. We agree that tailings are not unique, and that their potential for miuse depends on their accessibility. That is why we have adopted inhibiting misuse by physical means of limiting access as a goal of the standards.

Comment 36: EPA's assessments of the risks of intrusion into or misuse of tailings overstates the hazards and the need for prevention. Tailings are not acutely toxic, thus there is ample time to detect and correct intrusion and misuse before any individual is placed at significant risk. Studies of Grand Junction, EPA's prime example of misuse, have found no increase in fatalities or incidence of cancer. (I-6(3).20, I-6(H2).9)

Response: We disagree. Considering that tailings piles are not likely to be under frequent surveillance (indeed, Congress intended this to be the case), tailings could be removed for use at many locations before authorities noticed. It would require deliberate and costly searches to determine where the material had been taken, and additional expense to recover the tailings. We believe that inhibiting misuse by physical methods is one among several mutually compatible control objectives of reasonable and adequate standards for tailings piles. EPA has previously described the reasons such studies of Grand Junction are unlikely to be sensitive enough to detect health effects that are actually occurring (see the FEIS for Remedial Action Standards for Inactive Uranium Processing Sites, Vol. II, EPA 520/4-82-013-2, October 1982; Section D.2.1.2, Comment 15). We have estimated that 150 excess lung cancers would occur in the Grand Junction area from tailings used in construction if remedial actions were not taken.

Comment 37: EPA's justification of a 20 pCi/m^2-sec cover is based primarily on the premise that such a three meter cover is necessary to prevent misuse. This justification is flawed in two respects. First, misuse has not been widespread; rather misuse has been limited in both time and place, and either occurred before tailings were viewed as hazardous or as an intentional unlawful act. Second, burying tailings will not in and of itself prevent misuse. The key factor in preventing misuse is simply the knowledge that the material is hazardous. (I-6(3).18, I-6(4).11)

Response: See the response to Comment 26, A.5.0.

Comment 38: EPA's justification of 20 pCi/m^2-sec covers to prevent misuse after failure of institutional controls is both illegal and contrary to fact. The U.S. Constitution is intended to be perpetual. Further, UMTRCA provides generally for federal and state ownership and control of stabilized tailings and NRC has proposed a fund to assure annual inspection of every stabilized site. This is sufficient to prevent misuse. (I-6(3).19, I-7(2).23, I-4(3).14)

Response: Reliance on passive controls to protect health involves no implication or assumption that the U.S. Constitution was not intended to be perpetual. See the responses to Comments 23, 26, and 33, A.5.0.

Comment 39: EPA assumes that someone is living atop a pile and being exposed, but Federal law provides for Government ownership and control, making this assumption unrealistic. (P-28.3)

Response: EPA has not made such an assumption. We note in the Preamble to the Final Standard that "...even with the disposal actions required by these standards it would not be safe to build habitable structures on the disposal sites. Federal or State ownership of the sites is assumed to preclude such inappropriate uses."

Comment 40: The Grand Junction tailings misuse should not be applied to the development of environmental standards for tailings because these tailings were misused before there was realization that mill tailings might pose a hazard, and because they were available at no cost from an uncovered pile near the center of the city. (I-25.19, I-4(H2)5, I-22.14)

Response: See the responses to Comments 35 and 36, A.5.0.

Comment 41. Future tailings misuse is unlikely, considering that for it to occur all individual and institutional knowledge that tailings may be harmful would have to disappear, they would have to be discovered by someone planning substantial development, and the cost of excavating and transporting the tailings would have to be cheaper than the cost of commercially available sand near the construction site. (I-25.20, I-25.21)

Response: We have no assurance that people who were either ignorant of or uncaring about the hazard will not misuse tailings if they perceive some personal benefit from doing so. We agree that large-scale misuse seems unlikely. However, even small-scale uses of tailings can produce substantial lung cancer risks for the affected individuals, who may be entirely unaware of the origin of the materials used in or around their homes. Also see the responses to Comments 35 and 36, A.5.0.

Comment 42: There have been no reports of criminal trespass or theft of fencing on Homestake's property in Cibola County. (S-8.1)

Response: EPA staff have received numerous anectodal reports of fence thefts and vandalism in open areas of the West. An instance involving a Federally-owned tailings pile has been documented (Rogers and Sandquist, in a report to NRC, RAE-21-1, Rev. 1, August 1981). Also see the responses to Comments 32 and 33, A.5.0.

!EPA's Cover Standard Is Appropriate!

Comment 43: Two to three meters of overburden not only would attenuate radon release, but would protect the piles from erosional and dispersal forces. (P-13(2).7, P-23.3, P-26.8, S-1.2)

Response: EPA agrees.

Comment 44: The Agency has misstated the principal mechanism for long-term containment. EPA considers soil cover requirements, while the principal concern of long-term containment is geologic stability. (P-4(H1).6)

Response: EPA agrees that geologic stability is the principal factor in containment, but the cover is a very significant factor. However, covers are needed to control radon emissions and protect the tailings from penetration by water, apart from their role in containment. For these reasons, our analysis very thoroughly considered cover requirements.

!Surface Disposal Is Inadequate!

Comment 45: Below grade burial with staged disposal should be required for new tailings, and phased removal of existing tailings to trenches upon a finding that disposal of an existing pile in place will not meet the post-closure standards of 40 CFR 192.32(b). (P-1(2).43)

Response: If disposal of an existing pile in place will not meet the standards, we agree that disposal in trenches should be considered. In the Preamble to the Final Standards, EPA has announced its intention to consider whether work practice standards or other methods-specific standards such as staged disposal should be issued under EPA's Clean Air Act authority for the purpose of controlling radon emissions during operations.

Comment 46: We support a siting criterion that emphasizes disposal in stable rock formations which are isolated from groundwater supplies as well as from disruption by severe natural forces. (P-1(2).42)

Response: We believe our final standards will have the general effect the commenter has recommended.

Comment 47: We suggest that all licensed tailings should be buried to discourage disruption by humans and to assure isolation for the millenia of toxicity. (P-33.11, S-1.3, S-1.8)

Response: EPA considered this alternative and found it unreasonable. Adequate protection can be provided by disposing of existing tailings above grade. However, EPA encourages the disposal of tailings generated in the future in lined, below-grade impoundments.

Comment 48: EPA should consider deeper geological disposal, as liners have proven inadequate to serve their purpose for the full period of toxicity. (P-33.8)

Response: A liner is the primary standard for protecting groundwater. EPA is aware that liners sometimes fail. Therefore, EPA has a secondary standard to prevent groundwater from degradation by any seepage that does occur. This is adequate because the primary threat to groundwater occur during the mill's operation, when application of the secondary standards is assured. Over the long term, a suitable radon attenuating cover or low permeability cap will adequately prevent rain water from penetrating tailings and entering the ground whether or not a liner is fully functional. Finally, we note that deep burial might place tailings in groundwater.

Comment 49: There is much to be said for burial of tailings subgrade. (S-3(2).20)

Response: EPA agrees, with some reservations. See the responses to Comments 45, 47, and 48, A.5.0.

Comment 50: EPA's cover requirement is inconsistent with the requirements for substances EPA regulates under SWDA. Yet, those substances remain hazardous in perpetuity. Assuming any control is needed, a relatively dense cover (clay or rock) is all that is necessary. (I-6(3).21)

Response: Protecting groundwater from nonradioacrive contamination was the main concern for hazardous waste sites whereas attenuating radioactive radon emissions is an additional goal for tailings. Retaining moisture in the cover and the tailings helps to control such gaseous emissions. Therefore, in areas where groundwater would be adequately protected by an efficient radon attenuating cover, such a cover is consistent with the SWDA requirements. Where groundwater might not be adequately protected, such as in areas where there is a relatively high precipitation rate, the final standard requires a low permeability cap to be used, such as the combined plastic/clay/rock/soil caps required for hazardous waste sites. Under wet climate conditions, such caps may need little modification to satisfy the radon emission and longevity requirements.

Comment 51: EPA assumes an earthen cover of 3 meters is required for optimum cover design. However, the validity of the equations to calculate estimated cover thickness is questioned since the existing equations were derived from data that failed to consider such critical factors as residual moisture and compaction at optimum moisture. (I-1(2).35)

Response: EPA is aware of uncertainties in applying state-of-the-art attenuation equations to estimate long-term radon emission rates. The Preamble states that such uncertainties should be taken into account in designing disposal covers that provide "reasonable assurance" of complying with the numerical requirements of the disposal standards.

!*EPA's Cover Requirements Is Excessive*!

Comment 52: We do not support EPA's proposal to require 10 feet of cover on tailings piles. Considerably less than 10 feet of earthen cover would suffice to protect piles against erosion and with the proper type of cover, would also suffice to reduce radon levels. (I-4(H2).16, P-1(H2-1).7, I-6(3).5, I-6(H2).11, I-4(3).64)

Response: The standard does not require 10 feet of cover, but we do anticipate that satisfying the stated requirements will result in comparably thick, durable surfaces being placed over the tailings. By stating numerical radon emission and longevity requirements, and a narrative closure standard, EPA leaves the regulatory agencies and mill operators considerable flexibility in choosing cover designs to satisfy the standards.

Comment 53: EPA's proposed 20 pCi/m^2-sec cover is not required to protect groundwater in arid or semi-arid regions, since there will be no significant flow of water through the tailings. EPA's proposed 20 pCi/m^2-sec cover requirement is not necessary to protect groundwater in wet climates. The inactive Canonsburg site shows that one to two feet of clay is sufficient to protect groundwater in such regions. (I-6(3).24, I-6(3).25)

Response: Groundwater protection is only one among several disposal goals that are supported by such a cover. A thick earthen cover may not be "required" for groundwater protection in arid regions, but it serves to reduce water penetration during sporadic or seasonal high rainfall episodes. Also see the response to Comment 50, A.5.0.

Comment 54: EPA's 20 pCi/m^2-sec cover requirement is far in excess of what is needed to control erosion and is not cost/effective. EPA's guidance documents for hazardous waste sites suggests two feet of soil cover is sufficient to provide adequate erosion resistance. (I-6(3).22)

Response: The standard may lead to thicker covers than would generally be needed to control erosion alone. The RIA shows, however, that thicker covers are cost effective in achieving overall health protection, largely because they substantially reduce radon emissions and the potential for misuse.

Comment 55: If tailings are properly graded, covered, and provided proper drainage, thin covers of approximately one meter may not require long-term active maintenance. (I-1(2).36)

Response: EPA agrees, depending, of course, on site-specific details. However, also see the response to Comment 54, A.5.0.

!*Cover Should Not Be A Surrogate For Unrelated Goals*!

Comment 56: The issues of radon emission and tailings isolation/stabilization are separate, and requirements for their control should be developed independently. (F-3(2).19)

Response: As controlling radon emissions and providing for isolation/stabilization involve cover requirements, we don't understand how they could be considered entirely separately. However, we did consider them separately to a high degree, and provided individual specifications for them in the standard.

Comment 57: EPA should consider the practical means by which its inter-related goals can best be achieved instead of using the inter-relationship of the goals to justify its excess cover requirements. (I-4(3).71)

Response: EPA believes it followed the recommended approach to a greater extent than the commenter suggests. (See the response to Comment 56, above, for example.) EPA does not agree that its cover requirements are "excess." The requiremens are amply justified by their benefits of inhibiting misuse, avoiding lung cancers that might otherwise be caused by radon emissions, and limiting the risk to individuals who may live very near tailings piles.

Comment 58: The 20 pCi/m^2-sec radon standard is not necessary to achieve any of EPA's objectives. Individual standards should have been proposed for each objective, allowing implementing agencies and licensees more flexibility to design controls to achieve each standard. (I-10(2).6, I-12(2).2)

Response: See the responses to Comments 54, 56, and 57, A.5.0. The 20 pCi/m^2-sec standard is indeed necessary to avoid lung cancers that might otherwise result from long term radon emissions. Furthermore, EPA expects the standard will lead to cover designs that will significantly inhibit access to the tailings for misuse. Devising a separate standard for misuse within our authority would be conceptually very challenging, but is not necessary in view of our other approach to the problem.

Comment 59: EPA considers adequate stabilization - the prevention of dispersal of tailings by wind and water for the prescribed period - to be an integral part of its standard. Yet, it is not entirely clear from a review of EPA's proposal and supporting materials the extent to which EPA relies upon stabilization as support for the excess cover (i.e., approximately 10 feet) it projects as necessary to meet its standard. (I-4(3).62)

Response: The documentation in the EIS shows that a thicker earthen cover will generally be needed to satisfy the radon emission requirement than would be needed to stabilize the pile against erosion for 1000 years (assuming the surface is protected with stones). Also see the response to Comment 54, A.5.0.

Comment 60: EPA should base its radon standard on what is necessary to reduce the hazard associated with radon, not as a proxy for meeting other objectives. (I-10(2).4, I-4(3).69)

Response: See the responses to Comments 52-59, A.5.0.

Comment 61: Any proposed standards directed at controlling misuse should be segregated from the issues directed at controlling radon flux. (I-1(2).32)2

Response: See the response to Comment 58, A.5.0.

Comment 62: Radon emanation should not be used to formulate stabilization requirements. Stabilization and isolation should be addressed as distinctly separate issues from controlling radon emanation. (I-1(2).37)

Response: See the response to Comment 56, A.5.0.

!*Additional Comments*!

Comment 63: EPA's claim that the magnitude and frequency of floods can be predicted for periods of several hundreds of years conflicts with standard geomorphic and hydrologic thought. (S-3(2).17)

Response: The commenter may be overstating EPA's claims; indeed the DEIS noted that uncertainties in the characteristics of long term floods could affect disposal system designs. The FEIS and the Preamble address this point more thoroughly. We conclude that, in practice, disposal systems should be designed to withstand the "Probable Maximum Flood," which may be determined from site-specific meteorological limitations. This avoids inaccuracies associated with incomplete knowledge of long-term flood frequency/magnitude relationships.

Comment 64: We do not believe that tailings disposal areas should be released to unrestricted use. (S-3(2).20)

Response: EPA agrees. We have noted that building on the site could be unhealthful and needs to be restricted. The UMTRCA permits the NRC and the custodian of the site to allow appropraite uses, taking account, however, of the very long term persistence of the potential for tailings to be hazardous. See the responses to Comments 20 and 23, A.5.0.

Comment 65: We support a balanced approach between passive and institutional controls, the extent of which will be determined on a site-by-site evaluation. (I-12(2).5)

Response: EPA agrees with the Congress, which clearly intended to favor passive over institutional controls.

Comment 66: We believe that controlled access to closed tailings piles will be necessary even with cover, and that institutional controls such as fencing can be just as effective as cover in minimizing hazards from tailings. We believe that EPA's emphasis on a very thick cover does not take into account the very high costs of such covers or the very significant environmental impacts of obtaining appropriate soils in some areas. (F-5(3).5)

Response: As we indicated elsewhere (responses to Comments 23, A.5.0, for example) we believe Congress intends to minimize the use of institutional controls for tailings, and that institutional methods that are used should mainly supplement adequate physical controls. Despite our best intentions, long-term maintenance of fences is not as predictable as the stability of a cover. The RIA and FEIS contain extensive and detailed analyses of the costs of obtaining covers. We note that extensive use of "soils" (as "topsoil") is not required. The covers may consist mostly of common earthen materials. The commenter referred to testimony by officials of the State of New Mexico to the effect that very large soil areas may be impacted. The testimony does not indicate, however, that the New Mexico estimate was based on totally unrealistic assumptions. The officials assumed that the earth would be stripped only to a depth of 6-12 inches, and that piles would be graded to several times their present areas before being covered. Piles need not be so severely enlarged. Required earthen materials may be obtained in the customary way for such construction purposes, i.e., from existing earthen waste materials (which are common in mining areas) and borrow pits.

A.5.1 Period of Effectiveness (Longevity)

!The Required Period If Effectiveness Is Too Short!

Comment 1: The 200-year period of effectiveness proposed by the Agency is an unacceptably short time period. (P-4(H1).5, P-4(H1).7, P-4(H1).20, P-8(H1).14, P-8(H1).17, P-8(H1).18)

Responses: EPA has retained the 200 year minimum longevity requirement, for reasons given in the Preamble.

Comment 2: The longevity requirement should be at least 5,000 years to put the proper emphasis on control. The radon emanation standard provides an identifiable, measurable, and enforceable basis of determining longevity and integrity of the soil cover. (P-4(H1).16, P-4(H1).20)

Response: We do not know any specific design features that a 5000 year criterion would impose as distinguished from a 1000 year criterion, or, for that matter, a 200 year criterion. We believe that the proposed longevity requirement will produce the same long term protection, and be more suitable for assessment by engineers designing the disposal. See the Preamble for further discussion, and the response to Comment 26, A.5.1.

Comment 3: EPA should establish a minimum period of control of 1000 years, as specified by the NRC rules. (P-8(H1).14, S-12(H2).6, P-13(2).6, P-24.1, P-1(2).27, P-44.2, S-3(2).13)

Response: See the response to Comment 1, A.5.1.

Comment 4: Congressional intent was to control tailings until long after existing institutions can be expected to last. On this basis, 1000 years is not too long. (F-3(2).26, P-8(H1).17, P-8(H1).18, P-1(2).1, P-1(2).2, P-1(2).27, S-3(H2).12)

Response: We agree that 1000 years is not too long. We believe the final standard provides appropriately long-lasting protection, consistent with Congress' intent. See the Preamble for further discussion.

Comment 5: Consideration should be given to stabilization designed to accommodate the thorium-230 half-life (77,000 years), possibly by disposing of tailings in areas that are not influenced by erosion, such as heads of ephemeral drainage ways, behind topographical wind breaks, etc. (S-1.3)

Response: As discussed in the Preamble and FEIS, Volume I, we believe that the proposed longevity requirement gives adequate long-term protection. We do not know practical means of general application for stabilizing tailings for hundreds of thousands of years. See also the response to Comment 2, A.5.1.

Comment 6: Tailings should be stabilized on a responsible long-term basis. (P-6.3, P-25.1, P-32.5)

Response: We agree that the tailings should be stabilized on a reasonable long term basis and believe that our standard meets that need.

Comment 7: The time period for control in the standard should be driven by the consideration of the half-life of thorium-230, not just radium-226. (S-12(H2).1, P-1(2).27)

Response: See the response to Comment 5, A.5.1.

Comment 8: EPA should establish a minimum effectiveness requirement of 1000 years because of the long half-life of thorium-230, the high chances of flooding for shorter time periods, and the attendant benefit of controlling radon emissions. Modern engineering methods can assure covers lasting tens of thousands of years which would not be prohibitively expensive. (P-26.7, P-1(H2-1).6)

Response: For reasons discussed in the Preamble, we have retained the minimum 200 year requirement. Also see the responses to Comments 2 and 5, A.5.1.

Comment 9: Control technologies needed to meet thousands of years of containment have been proposed and approved for use by two mill operations in New Mexico. (P-1(2).35)

Response: No response required.

Comment 10: EPA should set a longevity requirement that addresses the thousands of years that tailings remain hazardous. (P-1(2).58, P-33.1, P-33.6, P-34.2, P-37.2, P-35.4)

Response: See the responses to Comments 2 and 5, A.5.1.

Comment 11: The longevity requirement should provide a minimum period of isolation of uranium tailings piles of 500 thousand years. (P-30.6, P-32.2)

Response: See the response to Comment 5, A.5.1.

Comment 12: EPA's rules replace consideration of long-term disposal procedures with short-term actions. (S-3(2).6)

Response: We believe that clarifying our intent that controls be designed to provide reasonable assurance of a longevity of at least 200 years and up to 1000 years meets the need for long term disposal. See the Preamble and the response to Comment 5, A.5.1.

Comment 13: EPA should establish a minimum effectiveness period of 1000 years because of the variability of the natural system and the unpredictable nature of ephemeral flow and thunderstorm events. (S-3(2).19)

Response: See the response to Comment 8, A.5.1.

Comment 14: EPA's adoption of the 1,000 year goal with a 200 year minimum is partly based on the fact that some existing piles are in floodprone areas and thus cannot assure 1,000 year containment. The Agency should have considered moving such piles rather than shortening the longevity requirements. (P-4(H1).19)

Response: The Preamble clarifies our intent regarding implementation of the standard. Whether a given pile shall meet this requirement in situ or shall be moved is a decision of the operators and of NRC or an agreement State as the regulatory agency.

!*The Longevity Requirement Is Appropriate*!

Comment 15: We agree with EPA's proposal to require maintenance-free stabilization of tailings for 200 years to 1000 years. (I-6(3).4, I-6(3).42, I-23.3, I-28.12, I-4(H2).1, I-4(3).68)

Response: See the response to Comment 1, A.5.1.

Comment 16: Requiring designs to be engineered for periods longer than 200 years is not feasible unless EPA affirms the use of an acceptable method to "prove" effectiveness. (I-6(3).42, I-23.3, P-28.4, I-19.12)

Response: We believe the Universal Soil Loss Equation should be a useful tool in estimating the site-specific effective disposal lifetime. However, we believe any additional geomorphic, seismic, and engineering information that may be useful in making such estimates should be applied. We require "reasonable assurance" not "proof" that the control system design is adequate to effectively control tailings for the required period. See the Preamble for further discussion.

Comment 17: We consider the 1,000 year to the extent reasonably achievable, and 200 year minimum stabilization requirement a practical approach to achieving the primary goals of limiting dispersion and misuse. (F-6(2).7)

Response: No response required.

Comment 18: We believe that the kind of performance standard proposed by EPA for effective cover life will allow the flexibility needed to permit licensees to design and NRC to analyze site-specific cover designs for compliance with the standard. (F-6(2).8)

Response: The standard applies to the design of the covers. Otherwise, no response is required.

!*Longevity Requirements is Unclear*!

Comment 19: EPA standards are ambiguous on the effectiveness requirement; is it 200 years or 1000 years? (S-5.9, S-12(H2).6)

Response: The Preamble contains a discussion of this issue.

Comment 20: EPA's longevity standards creates an ambiguity as to the amount of soil cover that is required if the standard is interpreted as requiring a radon flux of less than 20 pCi/m^2-sec after 1,000 years, 20 rather than 10 feet of cover could be required at the time of disposal. This should be clarified. (I-6(3).44)

Response: The radon flux standard applies over the entire control period. We believe the needed thickness is far less than the commenter indicates. See Chapter 8 of the FEIS, Volume I.

Comment 21: EPA should state the period of performance which must be met for non-radiological hazards. This should be the same as for radiological hazards. (I-6(3).45)

Response: We intend the longevity requirement to apply to the integrity of the control system. Radon gas is emitted from tailings to the air through the cover. Applying the longevity standard to the radiological hazard, in effect regulates the integrity of the cover and accomplishes our purpose.

Comment 22: In the longevity standard, EPA's use of the preposition "for" should be replaced by the phrase "up to", so that implementing agencies may not require costly efforts to prove that a cover system will last 1,000 years. (I-6(3).43)

Response: This issue is discussed in the Preamble.

Comment 23: The concept of "reasonable assurance" in meeting the 1,000 year disposal design limit is not clear. Moreover, we do not believe that it is cost effective to design controls to last for 1,000 years. Verifying such a design cannot be done, and EPA should abandon the concept. At most, the longevity requirement should be a few decades. (F-5(3).10)

Response: We have provided expanded and clarified discussions of reasonable assurance as regards the longevity standard (see the FEIS and the Preamble) to indicate that we expect standard engineering (design) criteria to be used to limit the probability of failure over the design period to a value consistent with other design situations where public health and safety are important concerns. We have also indicated the factors that we believe are most important to determining the longevity of an impoundment design. We agree that verification cannot be done. That is why the standard applies to the design of the disposal system. The weight of evidence in our rulemaking record indicates that the longevity standard is a workable regulatory requirement.

!*Additional Comments*!

Comment 24: EPA should analyze the potential means of cover degradation, over time. (P-22(H2).5)

Response: In the EIS, EPA outlined various means of degradation of protection, including erosion, deposition, flooding, climatic change, earthquakes, vulcanism, glaciation, and various human activities. See the FEIS, Volume I, Chapter 8.

Comment 25: EPA's claim that "flood protection must be based on very infrequent but high magnitude floods" (1,000 year flood) is inconsistent with Clean Water Act requirements, fails to consider the highly site-specific nature of the potential risk, and may lead implementing agencies to impose costly controls to minimize remote risks of insignificant tailings disruptions. (I-6(3).23)

Response: EPA is fully authorized to establish these standards for disposal of uranium mill tailings, independently of any Clean Water Act requirements that may have been established for other purposes. The need to consider floods follows from the requirement that piles be adequately controlled for up to 1000 years, and a recognition that, in general, flooding is one of primary disruptives forces that may occur over such a period. We do not believe that potential risk from such disruptions can be estimated site-specfically, because we cannot predict future human and environmental conditions site-specifically for such a long period. We do know, however, that any major disruption of a pile would increase its radon emissions to the air. Controlling such emissions is a goal of the standards.

Comment 26: Design events with return periods of 10,000 years or more must be used to achieve a containment standard of 200 or 1000 years. Maximum credible events should be used in the evaluation of tailings disposal areas so that an acceptable level of risk can be achieved. The use of maximum credible events is a well-understood, accepted practice in industry and government. (P-21(H2).1)

Response: As discussed in the Preamble and the EIS, we agree that tailings should be designed to withstand any disruptive events that have more than a small probability of occurring during the period for which "reasonable assurance" of control is required. In practice, this may be equivalent to considering maximum credible events.

A.5.2 Radon Emission Limit

!General Comments!

Comment 1: We concur with EPA's regulatory approach that the radon emanation limit applies to the design of the tailings disposal facility. (F-3(2).25)

Response: No response required.

Comment 2: The radon emanation rate standard determines the soil cover standard, and the longer you look beyond 1000 years the two standards become indistinguishable. (P-4(H1).18)

Response: The durability of the surface has a great deal to do with the longevity of the cover. Otherwise, EPA agrees.

Comment 3: The depth of cover needed to meet the radon emanation standard should be based on the estimated release at the end of 1000 years. Minimum cover depths should not be specified. The design necessary to meet the performance should be left to the regulatory agency. (S-3(2).14, S-3(2).15)

Response: We concur with the commenter. The regulations require that the radon emanation standard be met over the full required period of control, but the way in which this is to be done is not specified. However, see the response to Comment 1, A.5.1.

Comment 4: EPA should refrain from establishing any definitive position on cover designs and allow the NRC and the uranium mill operators to work out site-specific solutions to each of EPA's objectives. (I-30.4)

Response: We agree. See the response to Comment 3, A.5.2.

!The Radon Limit Is Too Stringent and Unjustified!

Comment 5: EPA's proposed 20 pCi/m^2-sec radon flux limit is not justified by the need to control radon or direct gamma radiation. Indeed, it is proposed as a proxy to require three meter soil covers which cannot be justified on the basis of prevention of misuse, prevention of surface spread of tailings, or groundwater protection. (I-4(3).9, I-4(3).34, I-4(3).69, I-6(3).17, I-10(2).5, I-10(2).11, I-28.11, I-22.1, P-29.4)

Response: The 20 pCi/m^2-sec radon emission limit combined with the longevity requirement can indeed be satisfied by a control system that appropriately employs a thick, durable cover, not necessarily 3 meters. Limiting radon emissions is only one among several goals of the standard, however. Our analysis addressed all these goals. We did not attempt to justify the radon emission limit solely on the basis of the need to control radon, but the RIA shows that there is such justification.

Comment 6: Even if EPA's excessive radon risk estimates are accepted, they do not reflect a level of significant risk that would warrant control. (I-5(2).11, I-6(3).35, I-5(3).36, P-29.1, I-25.16)

Response: See the response to Comment 7, A.5.2.

Comment 7: Given the de minimis risks, the minimal populations at risk, and the projected costs, the EPA-proposed radon flux limit of 20 pCi/m^2-sec is not justified and should be remanded for reconsideration and redevelopment. (I-1(2).41)

Response: The commenter states that the risks from unregulated radon emissions would be so low that regulation is unjustified. EPA does not agree, although we recognize that the risks are less than some from other causes. We are required by UMTRCA to "...make every reasonable effort to...prevent or minimize radon diffusion into the environment...from...tailings" We have concluded that uncontrolled radon emissions would produce both a high maximum individual risk (estimated as 2 in 100) and a high potential cumulative effect of thousands of deaths over time. We believe such effects require control. The commenter further states that the costs of regulation are excessive. Our studies, as given in the FEIS and the RIA, show that tailings can be disposed of in such a way as to limit radon emissions to 20 pCi/m^2-sec at a reasonable cost.

Comment 8: The radon emission limit is inappropriate because:

a. The radon flux limit is not to control radon emanation but to prevent misuse.
b. Radon emanation from tailings piles does not contribute a significant risk to the general population.
c. It is not even possible to measure the radon contribution from a tailings pond source term at a distance exceeding one mile.

(I-1(2).38)

Response:

a. See the response to Comment 5, A.5.2.

b. See the response to Comment 7, A.5.2.

c. The commenter confuses the detectability of a material with its presence. Radon released to the air continues to disperse until it is removed by radioactive decay. The sector-averaged Gaussian plume model has been used for years to estimate the concentration of material at a distance, using a source term and atmospheric and wind condition data. See the response to Comment 20, Section A.2.1.

Comment 9: Considering the fact that stabilization to prevent misuse and erosion is the primary objective of tailings control and the the cost benefit analysis fails to justify any additional cover solely for the purpose of radon control, we are unable to concur in the proposed radon emission limit. (P-9(3).7)

Response: We believe that protecting people from radon emissions is an objective of tailings control as well as inhibiting misuse and erosion. See Section 8 of the FEIS. We have considered the cost of radon control in our analysis for the regulations. See the response to Comment 7, A.5.2.

Comment 10: If a radon standard is deemed necessary, the 10 CFR Part 20 values of 3 pCi/l for unlimited access and 1 pCi/l for permanent access are appropriate. (P-9(H1).12, I-6(4).9, I-30.3)

Response: The concentrations in 10 CFR 20 are intended to determine those areas associated with an operational facility for which public access restrictions are needed to control radiation exposure. 10 CFR 20 also requires operators of such facilities to keep radiation exposures as low as reasonably achievable, notwithstanding these maximum allowable concentrations. EPA is following established radiation protection practices by issuing generally applicable standards for such facilities.

!*The Radon Flux Is Too High*!

Comment 11: The 20 pCi/m^2-sec limit may produce unacceptable population doses in eastern (more populated) states. The proposed limit should be reexamined. (P-4(H1).22, P-5(H1).17)

Response: We don't believe there is a valid basis for the statement. The most immediate prospects we know of for uranium milling in the East involve currently rural areas. Therefore, we don't expect there to be large populations very near the tailings, at least in the near future. Radon emitted from tailings in these areas would quickly be carried to the ocean. Although we have not carried out a risk assessment specifically for an eastern mill, we believe the results would not be qualitatively different from our assessment results for inactive and active mills in the West.

Comment 12: To allow increases in radon emanations (up to 20 pCi/m^2-sec) in an area of dense population removes people's opportunity to choose to live at background exposure levels. (P-5(H1).11, P-5(H1).5, P-5(H1).18)

Response: From Table 5-1 of the FEIS we may infer that radon from a tailings piles that satisfies the standard will increase the natural radon background rate by a small fraction at any distances from the pile that people are likely to live. The estimated risk for people who live permanently very close to tailings piles can still be relatively high, up to 1 in 1000 for an emission limit of 20 pCi/m^2. We concluded that it is not reasonable to reduce the emission standard below this value because of (1) the uncertainty associated with the feasibility of implementing a significantly lower standard, (2) the small increase in total health benefits associated with the thicker covers that would be required, and (3) the limited circumstances in which the maximum risk to individuals might be sustained. (See the Preamble for further details). In a practical sense, people's opportunities to live at background levels will not be affected by the standard.

Comment 13: The residual risk of two in 1,000 allowed by EPA's proposed radon limit is too high and illegal under Section 112 of the Clean Air Act. (P-45.13)

Response: We now estimate the maximum risk at about 1 in 1000 (see the response to Comment 12, above). Because this risk is relatively high, we carefully examined whether the standard should be significantly lowered (see the Preamble for details). As noted above (the response to Comment 12), we found it could not.

Comment 14: EPA should require that sufficient cover material is provided to reduce the radon emission level to as near to background as possible. (P-26.12, P-45.7, P-5(H1).14, P-49.4)

Response: EPA believes the final standard reduces emission rates as low as is reasonable (see the response to Comment 12, A.5.2).

Comment 15: We support a 2 pCi/m^2-sec emission standard (as specified by the NRC rules). (S-12(H2).2, P-26.10, F-3(2).5, P-6(2).2, P-1(2).6, P-1(2).26, P-1(2).28, P-1(2).57, P-13(2).8, P-30.7, P-37.3, P-36.3, P-44.3, P-49.2)

Response: Our analyses indicates that a standard of 20 pCi/m^2-sec is as low as may reasonably be achieved. See the response to Comment 12, A.5.2.

!Alternative Limits Proposed! .

Comment 16: After reclamation, tailings should meet a radon concentration standard at the downwind edge of the tailings equivalent to the radon emission rate. (P-1(2).44, P-1(2).59)

Response: See the response to Comment 16, A.1.2.

Comment 17: We recommend that a performance standard of 0.5 pCi per liter be applied upon stabilization of the impoundment. (S-12(H2).2)

Response: See the response to Comment 10, A.1.2.

Comment 18: We recommend a regulatory standard in terms of concentrations of radon decay products, and support the levels prescribed by 10 CFR Part 20 (0.03WL). As an alternative, the NCRP is recommending an exposure limit for radon decay products of 2 WLM per year. (I-6(H2).12, P-29.3, I-25.16, I-19.11, I-4(H2).10, I-4(H2).11, I-6(4).9)

Response: See the responses to Comment 17, A.5.2, and Comment 13, A.2.0.

Comment 19: We recommend that the radon protection standard be based on a concentration limit in air of 3 pCi/l/.03 radon daughters working level. (I-12(2).1

Response: See the response to Comment 17, A.5.2.

!EPA Should Clarify The Standards!

Comment 20: EPA should clarify whether the 20 pCi/m^2-sec is only a design standard or both a design and performance standard. (S-13(H2).2)

Response: The emission rate standard of 20 pCi/m^2-sec is a design standard. Clearly, performance over 200-1000 years should not be monitored.

Comment 21: The footnote to the radon emission standard (192.32(b)(1)(ii)) should be clarified to express EPA's purpose, that for purposes of satisfaction of the radon emission standard, only radon from tailings should be counted. The footnote should also prescribe a limit to the amount of radioactive materials in the cover. (P-1(2).62)

Response: The footnote states that only radon from uranium byproduct materials (tailings) should be counted. It also states that releases of radon from the covering materials should be estimated in the closure plan, although it is not included in the release limit. The selection of cover material is a regulatory matter.

!Analysis Is Inadequate To Justify Standard!

Comment 22: EPA should clarify its basis for the 20 pCi/m^2-sec radon standard. Is the basis feasibility, acceptability of risk, a combination of the two, or some other factor? (P-9(H1).3)

Response: The Preamble discusses how the radon emission limit combined with the control longevity requirement addresses several objectives: long-term containment of tailings, reduction in risks associated with radon emissions water protection, and protection against misuse. The overall basis for the entire standard is to reduce health and environmental hazards to the lowest reasonably achievable level, consistent with any legislative constraints.

Comment 23: EPA should clarify the technical basis for its 20 pCi/m^2-sec standard. There is no logical connection between radium in the soil, radon emission rates, and health effects. (P-9(H1).4)

Response: We believe the technical basis for the rule is clearly stated in the Preamble and supplemented by the information in the EIS, RIA, and other referenced documents. The statement that there is not a logical connection among radium concentration in soil, radon emission rates, and estimated health risks to people is incorrect. Clearly, the higher the radium concentration in soil (or tailings), the higher the rate of emission of radon, the direct decay product of radium. The radon emission rate from a tailings pile is in turn directly relatable to radon and daughter transport to populations through models employing long-range meteorological transport calculations in common use throughout the nuclear industry. Because of this direct relationship, the proposed standard for disposal of tailings piles is expressed as a limitation on the radon flux from the surface of the tailings. This relationship between radium, radon emissions, and health risks has been documented in publications of the International Commission on Radiation Protection, the United Nations Scientific Committee on the Effects of Atomic Radiation, and, recently, in draft NCRP reports.

Comment 24: There is insufficient justification given for using radon flux measurements for specifying cover thickness. The number in the Table in 48 FR 19590 of estimated cover thickness to achieve 20 pCi/m^2-sec have never been confirmed by field measurements. (I-22-8)

Response: There is some field information available regarding the practicability of reducing radon emissions to levels approaching background. This information, reviewed in the Preamble, is in reasonable agreement with predictive calculational models, at least with regard to designing covers to satisfy the final standard (20 pCi/m^2-sec). EPA recognizes, however, that uncertainties remain, and we have discussed in the Preamble how such uncertainties should be taken account of in providing "reasonable assurance" that the standard will be satisfied. Some of these uncertainities involve predicting the performance of the cover over time, particularly as the moisture in the cover changes. However, contrary to the commenter's implication, the standard does not require flux measurements. The standard applies to the design of a cover, which may be carried out from measurements of physical/chemical properties of the tailings other than flux.

Comment 25: There is strong evidence to indicate that the ultimate effects of covering tailings will be much different and the radon release rates will not be as predicted. For example: the transport effects of barometric pressure changes, temperature changes, gas and water vapor effects are expected to increase the radon movement by substantial amounts. (I-29.1)

Response: See the response to Comment 24, A.5.2. We recognize these phenomena and have considered them carefully. We believe these factors need to be taken into account in designing covers that provide "reasonable assurance" of satisfying the 20 pCi/m^2-sec limit for up to 1000 years.

Comment 26: Moisture effects on the cover and the tailings may be much more complicated than indicated in the DEIS. Because of this and other uncertainties, we believe it would be essential to measure the radon concentrations in the areas around the tailings piles after corrective actions are taken. (I-29.2)

Response: We have noted that changes may occur over long periods of time after disposal that may affect radon emission rates. We do not intend compliance with up to a 1000 year requirement to be determined by monitoring. Therefore, while monitoring may be useful for research and development purposes, we do not require monitoring for regulatory compliance. See the response to Comments 24 and 25, A.5.2.

Comment 27: The Agency should include alternatives between the 20 pCi/m^2-sec and 2 pCi/m^2-sec radon levels proposed in the DEIS. (P-4(H1).11)

Response: We have made an analysis for a radon emission rate limit of 6 pCi/m^2-sec in addition to the values of 20 and 2 pCi/m^2-sec. This analysis indicates that the standard of 20 pCi/m^2-sec is the lowest that is reasonably achievable.

A.5.3 Radium-226 Soil Concentration Exemption (40 CFR 192.32(b)(2))

Note to the reader: The purpose of the proposed standard is discussed in the response to Comment 24, A.5.3, below.

!*The Standards Are Too Stringent*!

Comment 1: We oppose EPA's proposal to require clean up of restricted areas to radium-226 concentrations of 5 pCi/g of soil in the surface and 15 pCi/g of soil in the subsurface. No justification is presented for such a stringent standard, and the limits are far below levels where, under any reasonable scenario, these is a significant risk. (I-6(3).10), (I-6(3).74), (I-25.17), (I-4(H2).12), (I-4(3).59), (I-4(3).51), I-4(3).55)

Response: We do not agree that this represents an overly stringent standard. Higher concentrations in a substantial quantity of subsurface soil under a house can be expected, on the average, to result in indoor radon levels in excess of 0.02 working levels, and could pose clearly significant risks. Thousands of acres of land may be involved, which, if adequately cleaned up now, could be used without restrictions for the indefinite future. The costs and benefits of alternative standards are discussed in Chapter 9 of the FEIS.

Comment 2: The radium-in-soil standard appears to be arbitrarily established as a number above background; it should be justified on the basis of potential health effects. (S-13(H2).1)

Response: The standard was established on the basis of potential health effects. The value was influenced by the need to provide a reasonable margin above background so as to make implementation reasonably achievable. Furthermore, the purpose of the standard is to clean up tailings, not to reduce background levels of radium.

Comment 3: A limit of 20 pCi radium-226 per gram of soil is more appropriate than 5 pCi on the basis of estimated risk in residences. (I-25.17, I-25.18, I-4(3).55)

Response: See the response to Comment 1, A.5.3.

Comment 4: EPA's radium-in-soil standard is overly conservative since it is too closely related to fluctuations in natural background levels of radium-226 is soil. (I-4(3).52, I-4(3).59)

Response: The standard applies to radium-226 in byproduct materials, and is well above normal background levels.

Comment 5: In deriving its radium-in-soil standard, EPA made a number of excessively conservative assumptions which render the standard highly questionable; for example, EPA did not take into account a barrier factor which limits radon diffusion from soil into a dwelling, nor did EPA allow for more than one full change of air per hour. (I-4(3).54, I-4(3).56)

Response: Experience in Florida, Canada, Colorado with remedial measures for indoor radon do not justify taking any credit for barriers. Similarly, one air exchange per hour is normal, and will probably decrease in the future due to economic pressures for energy conservation.

Comment 6: Neither radium-226 in contaminated soil in the vicinity of piles, nor radon emanating from such soil pose a health risk from inhalation, ingestion, or external exposure under any reasonable scenario. Therefore, the 5 pCi/g radium-266 standard within the restricted area is unreasonable. (I-6(3).76)

Response: See the response to Comment 1, A.5.3.

Comment 7: The proposed Radium-226 standard in soil of 5 pCi per gram of soil constitutes a negligible health risk with a substantial economic burden. Originally, the limit was based on asserted correlations between radium concentration in soil and radon progeny concentrations inside structures built on reclaimed phosphate wastes in Florida. Its application to the uranium mill tailings standards is questionable. (I-2(2).10)

Response: There is no basis for assuming that the results obtained in Florida (and elsewhere) will not apply to areas where tailings are disposed of.

Comment 8: Realistic scenarios should be considered. Standards should be predicated on realistic scenarios based on both current and projected land use patterns, institutional land-use controls, construction codes for ventilation, and active maintenance to restrict residential development on such lands. (I-1(2).47)

Response: EPA does not agree that protection of public health over the period these hazards will continue to exist should be predicated on the assumption that institutional controls will be maintained when simple and inexpensive cleanup can make their use unnecessary.

Comment 9: EPA's assumptions in developing the Ra-226 standard are erroneous.

a. EPA's response appears based on studies performed on slab-on-grade homes constructed in Florida. This construction technique is atypical for homes built in the western U.S.

b. Calculated values derived from EPA data in no way correspond to EPA assumptions.

c. EPA overestimates the indoor radon decay product level.

d. EPA overestimates the radon emanation rate in soils beneath a home.

(I-1(2).42)

Response: The correctness of EPA assumptions regarding indoor radon is exemplified by the observations that the average indoors radon decay product level in U.S. homes is approximately 0.004 WL, and several times this level is not unusual. This is attributable to an average soil concentration of somewhat less than 1.0 pCi/g radium-226. (It is well-documented that most indoor radon is attributable to soil radium.) In general, higher radium concentrations under a house will produce higher radon levels inside the house.

Comment 10: Given the degree of conservatism realized by EPA, it is evident a uniform concentration of 30 pCi Ra-226/gram would result in a residual risk of lung cancer of less than 0.1 hypothetical case in 100 individuals, a value EPA deems acceptable. The cleanup costs would be correspondingly lower--i.e., less than $12 million for all mills considered vs. $80 million under the proposed standard. (I-1(2).44)

Response: We estimate that 30 pCi/g radium in subsoil under a house could, on the average, result in more than 0.1WL in indoor air. This would result in a greater than 1 in 10 lifetime risk of lung cancer for each resident, a clearly unacceptably high risk. See Chapter 9 of the FEIS for EPA's far lower estimate of the cleanup costs under the standard.

Comment 11: EPA has not shown an abnormal or excessive threat to health exists from soils containing 30 pCi radium-226/gram. (I-1(2).45)

Response: See the response to Comment 10, A.5.3.

Comment 12: EPA should not require cleanup of mill areas where there are no tailings and where only low levels of contamination exist, say under 50 pCi Ra-226/g. (I-13(2).3)

Response: See the response to Comment 10, A.5.3.

Comment 13: EPA's proposed cleanup levels are commonly found as background levels in mine/mill areas. (I-13(2).4)

Response: See the responses to Comments 2 and 4, A.5.3.

Comment 14: EPA should base any general cleanup standard not on radium concentration in the soil, but on assuring a maximum radon daughter concentration in a habitable structure. (I-13(2).5)

Response: The conditions exempting parts of tailings sites from the disposal standards serve two purposes: (1) to avoid high wholebody gamma exposures due to surface contamination, and (2) to avoid high indoor radon levels in structures due to subsurface contamination. If the mill operators cleanup the land upon closure, then the post-closure Federal or State custodian will not have to supervise as much land, nor monitor its use as closely.

Comment 15: Post-closure standards should apply where radium concentrations exceed pre-operational background levels. (F-3(2).7)

Response: See the responses to Comments 2 and 4, A.5.3.

!*Standards Are Too Lax*!

Comment 16: If sampling shows that contamination has moved more than one foot into soils due to the spread of tailings, cleanup should be required to such a depth that will comply with a 5 pCi/g radium-226 concentration. (P-26.22)

Response: Experience shows that when tailings are found deep below the surface they were usually deposited there in concentrated form. the 15 pCi/g standard should easily include such tailings.

Comment 17: By conforming the radium-226 requirement to the disposal site EPA ignores the radon contribution from potentially windblown tailings. Thus, the radium-226 requirement should apply to areas outside of the facility's restricted area. (P-1(H2-1).4, P-1(2).30, P-1(2).61)

Response: The question of the applicability of NRC or Agreement State authority to off-site areas is outside EPA's jurisdiction. However, if clean-up of such areas is carried out, the standards are appropriate for this application.

Comment 18: EPA's proposed radium-226 limitations in soils must include provisioning for cleaning up tailings that have been moved from the disposal area. (P-26.19)

Response: See the response to Comment 17, A.5.3.

Comment 19: All lands in and around the tailings containing radium-226 concentrations in excess of 5 pCi per gram of soil should be cleaned up and disposed of in lined trenches. (P-1(2).45)

Response: The appropriate location for materials removed from such lands is a disposal area. However, EPA does not specify the means of satisfying its standards.

Comment 20: We support a maximum radium-226 concentration in contaminated soils on and outside of the mill site of 5 pCi/g of soil in the first 12 inches. (P-37.5, P-30.7, P-36.3, P-26.21, P-13(2).9)

Response: See the response to Comment 17. The depth to which the standard for surface cleanup applies is largely governed by consideration of the monitoring depth possible for gamma survey instruments. A depth of 12 inches would require coring, a much more expensive survey technique.

Comment 21: The radium-in-soil standard appears to be arbitrarily established as a number above background; it should be justified on the basis of potential health effects. (S-13(H2).1)

Response: See the response to Comment 2, A.5.3.

Comment 22: The Agency's proposed standards mirror a request by Union Carbide to delete the clause in the standards (192.32(b)(2)), which includes mine or waste rock byproducts with elevated levels of radium. (P-5(H1).4)

Response: The comment is incorrect. The standards apply to byproduct materials, as defined in UMTRCA 78.

!*Standard Is Unclear*!

Comment 23: The proposed radium-in-soil standard is subject to divergent interpretation. (S-12(H2).3, P-26.20)

Response: The wording has been clarified.

Comment 24: The radon standard is flawed in that it covers only areas with high radium soil concentrations. The Agency's intent appears to have been to set a different radon standard for contaminated areas adjacent to the tailings, but that is not what the letter of the rule provides. The rule appears to exempt tailings covered with low radium content soils. (P-4(H1).14)

Response: EPA intended the proposed Section 192.32(b)(2) to distinguish disposal areas for tailings piles from other land areas on disposal and/or licensed sites that are sufficiently uncontaminated by tailings as to not require application of the disposal standards of Section 192.32(a) . The definition of "disposal area" and the language of Section 192.32(b) have been revised to clarify this objective.

Comment 25: It is unclear whether EPA's proposed radium-in-soil standard is to apply to cover materials for tailings piles. If so, EPA's proposed radon emanation standard of 20 pCi/m^2-sec could effectively result in as little as 5 pCi/m^2-sec of radon. (I-4(3).53)

Response: See the response to Comment 24, A.5.3.

Comment 26: It is not clear how EPA's proposed radium-in-soil standard relates to EPA's proposed post-closure radon emanation standard. (I-4(3).52)

Response: See the response to Comment 24, A.5.3.

!*Other Comments*!

Comment 27: The proposed radium in soil standard should be reconsidered because it could be applied under RCRA or SWDA to characterize certain substances as hazardous wastes. (I-4(3).61)

Response: Such an application would have to be the subject of a formal rulemaking, and is not a reason for changing this standard.

Comment 28: We recommend there be a prescribed depth below the surface to which the standard applies. (I-5(2).13)

Response: We did not specify a depth because we believe that this should be left to the regulatory agency to determine on a site-specific basis. This will make it possible to minimize unnecessary and expensive subsurface measurements.

Comment 29: Standard procedures for measurement should be developed. (I-12(2).3, P-49.3)

Response: We presume that the NRC will develop and/or encourage such procedures if the need arises as part of its implementing role. We are aware that NRC has the necessary experience as a result of investigations it sponsored in South Dakota and elsewhere.

A.6.0 IMPLEMENTATION

Comment 1: EPA should discuss the establishment of an environmental monitoring program, which is a fundamental part of the implementation of these standards. (S-6.6)

Response: NRC and Agreement States have the responsibility under UMTRCA of implementing the standards. EPA will keep informed of the adequacy of the implementation and will consider revising the standards or issuing such guidance if the need to do so should become apparent.

Comment 2: The standard should provide guidance on the scope of a radiological monitoring program that should be conducted during the processing operation, closure period, and after the closure period. (F-2.1)

Response: See the response to Comment 1, A.6.0.

Comment 3: Pre-operational monitoring must be required to assure the validity of operational monitoring. (P-3(2).4)

Response: See the response to Comment 1, A.6.0.

Comment 4: EPA's rules don't even support fines or shutdowns if an operator chooses to ignore its rules. Fines for violation of operating standards should be suggested by the EPA to the NRC. EPA should indicate that there would be action taken for noncompliance. (P-8(H1).10, P-8(H1).22)

Response: As we noted, above, NRC and Agreement States are responsible for implementing the standards EPA issues under UMTRCA for active uranium mills. The NRC is authorized to establish civil penalties for violations. See Section 205 of UMTRCA.

Comment 5: EPA's current deference to the NRC for enforcement could be used by opponents of the regulation to delay any action for many years. (P-2.8, P-2.7)

Response: EPA has not deferred to NRC; the Agency is carrying out its responsibilities under UMTRCA to set standards that NRC and Agreement States are responsible for implementing. Where appropriate, such as with respect to initiating programs to attain compliance with groundwater protection standards, we have specified time limits. However, we believe other compliance decisions are most appropriately made site-specifically, i.e., by the implementing agencies.

A.6.1 Standards for Operation

Comment 1: EPA's proposed nondegradation standard for groundwater may not be feasible to implement since it is extremely difficult to establish background levels in a mineralized region. In an area such as Ambrosia Lake, where the up-gradient aquifers have been drained, establishing background levels is impossible. Even if feasible, the economic costs would make implementation unreasonable. (I-6(3).59, I-6(H2).23, I-6(H2).24, I-7(2).8)

Response: The SWDA regulations applicable to monitoring requirements and programs (40 CFR 264.97 through 264.99 and Appendix IV of 40 CFR 264) provide complete criteria for establishing background concentrations of hazardous constituents, including situations where background sampling wells are not upgradient from the piles (40 CFR 264.97(g)(3)). NRC has the responsibility for addressing this issue in their regulations. The costs are discussed in the responses to Comments 31 and 32 in Section A.3.3.

Comment 2: Decontamination of impacted groundwater should begin immediately for existing sites where contamination problems are documented or where contamination is discovered as a result of investigations conducted under the proposed compliance program in 40 CFR 192.33. (P-26.25)

Response: We would agree that remedial actions should begin as soon as practicable. However, in fairness to the licensee, an orderly process should be conducted to determine noncompliance with the standards, and adequate time allowed to design a suitable remedial action. The standard allows up to 18 months for remedial actions to be put into operation following a noncompliance determination by the regulatory agency.

Comment 3: EPA should require monitoring of the vadose zone so that the nondegradation standard of 40 CFR 264.92 can be met and contamination controlled before it reaches an aquifer. (P-1(2).38, P-1(2).48, P-1(2).54)

Response: Monitoring of indicator contaminants is discussed in the Preamble. NRC will develop monitoring programs that are at least comparable with the SWDA monitoring requirements. See the response to Comment 1, A.6.1.

Comment 4: Surveillance of emissions, liquid discharges, and environmental levels of radiation should be conducted in and around mill tailings sites by EPA personnel. (P-30.9)

Response: See the responses to Comment 1, A.6.0, and Comment 3, A.6.1.

Comment 5: The compliance program requirements of 40 CFR 192.33 fall short of providing a remedy for noncompliance; there is no provision for formal remedial action to correct a lingering problem. (P-1(2).52)

Response: The requirements of 40 CFR 192.33 incorporate 40 CFR 264.100 which requires that: "The owner or operator must continue corrective action measures during the compliance period to the extent necessary to ensure that the groundwater protection standard is not exceeded. If the owner or operator is conducting corrective action at the end of the compliance period, he must continue that corrective action for as long as necessary to achieve compliance with the groundwater protection standard." (40 CFR 264.100(f)). This adequately addresses "lingering" problems.

Comment 6: EPA should specify the procedures for applying for an exemption to the liner requirement and the criteria on which such an application will be reviewed. (I-25.8)

Response: The criteria for considering such applications are described in 40 CFR 264.221(b).

A.6.2 Standards for Disposal

Comment 1: The Clean Air Act requires monitoring to assure the emission standard is being met. (P-45.14)

Response: We have issued a design standard because we believe it is impractical to monitor tailings piles for the up to 1000 years the standard applies and because short term monitoring will not reflect the long term performance of the control method.

Comment 2: Tests of compliance of the disposal standards by monitoring of radon appear to be an absolute minimum requirement. (P-7.3, S-5.8, P-45.27)

Response: EPA disagrees, for reasons stated in the response to Comment 1, above. We require reasonable assurance of compliance with the numerical radon emission requirement by careful design and execution of a disposal system.

Comment 3: We agree with EPA that the post-closure environmental groundwater monitoring should be site-specific rather than the standard 30-years normally required under the Solid Waste Disposal Act. (F-3(2).15)

Response: NRC is responsible for establishing post-closure monitoring requirements that are comparable with those EPA established for hazardous wastes under the Solid Waste Disposal Act. The regulatory agency should recognize, however, that monitoring of groundwater for shorter or longer periods than 30 years may be needed for the specific sites where tailings are located.

Comment 4: Variations in climate require that a maintenance and control monitoring program should be established so that corrective action can be taken promptly, if needed. (F-1.3), (P-2.6), (P-7.3), (S-5.8)

Response: NRC is authorized to establish such programs as it may find necessary, and which are comparable with corresponding requirements EPA has established for hazardous wastes.

Comment 5: We suggest that an adequate test program for the materials involved in reclamation should be a requirement, and that maintenance and control monitoring be followed with prompt corrective action if the opening of potential vertical channels occurs. (F-1.3)

Response: EPA agrees that providing "reasonable assurance" of compliance with the standard requires that adequate information be obtained. This is a regulatory function to be performed by NRC and Agreement States. Also see response to Comment 4, A.6.2.

Comment 6: Some provision should be made for practical monitoring of heterogeneous waste by gamma-measurements, water concentrations, and measurements of working levels. (P-2.6)

Response: We have emphasized in the Preamble to the standards that providing reasonable assurance of compliance with the standards depends on obtaining sufficient knowledge of the materials that are involved and making reasonable allowance for uncertainties. The regulatory agencies may develop their own procedures for obtaining such information, however.

Comment 7: Determining compliance with the radium-226 concentration criteria will be very difficult, and the standards should address the methodologies acceptable for implementing these standards. We support the use of gamma survey techniques as an acceptable methodology. (F-3(2).27)

Response: EPA investigated the practicality of making such measurements when the Agency established cleanup standards for inactive uranium processing sites. (See the FEIS for Inactive Sites, especially Volume II.) The Department of Energy and the Nuclear Regulatory Commission have been performing such measurements in several of their programs. We agree that gamma ray survey techniques can be very useful in this regard. However, we believe it is not necessary for EPA to specify methods of implementation, which is more properly a regulatory function.

Comment 8: We are concerned that the radium-in-soil exemption could be implemented by selective sampling, and not by proper sampling based on a 95% confidence test. (P-1(2-1).2, P-1(2).30, P-1(2).61)

Response: See the response to Comment 7, A.6.2. We believe establishing such procedures is a regulatory function. As with other aspects these standards, however, we intend to monitor implementation and will consider additions or revisions if the need to do so should become apparent.

Comment 9: Radon measurements should be made on the piles with a closed cover with the atmosphere interface. Monitoring at the site boundary does not give a realistic picture of the radon coming off the piles. (P-16(H2).2)

Response: We certainly agree that measuring at the site boundary would be a very difficult way to determine emissions from a pile. Our standards do not require radon measurements to be made, however, so it is not necessary to discuss radon measurement techniques in any detail.

!Additional Comments!

Comment 10: A large, permanent marker should be erected to mark the location of uranium tailings piles. The boundaries of the disposal area should also be permanently marked. (S-1.6), (S-1.7)

Response: We believe consideration of such markers is a regulatory function to be performed by NRC and Agreement States.

Comment 11: EPA should require disposal (covering) operations to begin immediately at existing sites where portions of tailings have dried out. (P-26.24)

Response: We noted in the Preamble certain difficulties in deciding when closure of a tailings impoundment should take place. We have decided that the regulatory agency should determine the time of closure, by site-specifically judging the advantages and detriments of all pertinent factors, some of which are discussed in the Preamble. We specifically noted, however, that some older mill sites already contain filled impoundments, and we urge the regulatory agencies to promptly identify and require disposal of tailings in such impoundments.

Comment 12: EPA's suggestion that NRC adopts a 30 year post-closure monitoring requirement is contrary to congressional intent. Since the tailings will be owned by the government after closure, any monitoring is properly their responsibility. (I-6(3).72, I-7(2).14)

Response: UMTRCA directs NRC to establish general requirements for tailings that are at least comparable to requirements EPA has established for hazardous wastes. See the response to Comment 3, A.6.2.

A.7.0 MISCELLANEOUS COMMENTS

!*Editorial Errors*!

Comment 1: On page 19588, Column 1, bullet 2 "disposal" should read "dispersal". (F-3(2).5)

Response: The comment is correct.

Comment 2: On page 19588, Column 2, it is misleading to refer to the gamma radiation dose rates as "high". This refers to dose rates of 3 mr/h and less. We suggest that a more accurate word be chosen to describe gamma doses. (F-3(2).7)

Response: Considering that the term clearly refers to doses for the general public from an environmental radiation source, we believe the statement requires no revision.

Comment 3: On page 19597, Footnote 1 to the Table in Column 3, EPA meant to say, "We assume that the average radon-222 emission rate from existing and future tailings will be 500 pCi/m^2-sec and 300 pCi/m^2-sec, respectively." (F-3(2).18)

Response: The comment is correct.

Comment 4: The exemption in Section 192.32(a)(1) to the monitoring requirements of 264.228, referenced in 264.221 must be misreferenced. 40 CFR 264.221, revised July 1, 1982, makes no reference to 264.228.

Response: The revisions to 40 CFR 264 published in Volume 47 of the Federal Register on July 26, 1982, (pages 32274-32388) include a Section 221 that refers to Section 228.

!*Undue Influence Should Be Disclosed*!

Comment 5: The panel members for the EPA rulemaking should be required to file affidavits concernings potential conflicts of interest. (P-30.12)

Response: EPA follows the conflict of interest provisions of 40 CFR 3. These include the periodic filing of "confidential statements of employment and financial interests" by the staff involved with this rulemaking. These statements are reviewed by senior agency officials under procedures established and administered by the Office of General Council. Based on statements filed [illegible] the staff of the Office of

Radiation Programs in 1983, the reviewing officials concluded there were no potential conflicts of interest relating to the development of these standards.

Comment 6: If OMB or any other agency has influenced EPA's proposed rulemaking or the development of its standards a full disclosure should be made of the nature of this involvement. (P-32.3)

Response: Communications regarding OMB's review of the final standard are filed in the rulemaking docket (Docket Number A-82-26).

!*Application to Other Industries*!

Comment 7: EPA's regulatory approach for mill tailings would be inappropriate for industries which encounter radionuclides as a secondary by-product. EPA should not consider comparable regulation for phosphogypsum. (I-24.1)

Response: This rulemaking applies only to uranium and thorium processing sites where source material is the primary product.

Comment 8: It is doubtful that a mineral extraction industry could survive if EPA's proposed controls were applied to all mining and milling operations. (P-29.6)

Response: EPA has analyzed the effects of the standard on the uranium and thorium processing industries to which they apply. Based on our analysis in the RIA, we believe there will not be any major economic impacts on the uranium industry. EPA has not analyzed any hypothetical application of similar standards to other industries.

!*Additional Comments*!

Comment 9: The statement made in the RIA that "historically there has been no federal regulatory control of uranium mill tailings," is at best a fiction. Tailings were recognized as a problem previous to the passage of UMTRCA. The NRC began requiring tailings disposal plans consistent with their current regulations beginning in 1965. (P-4(H1).1)

Response: The statement has been revised; "no" has been replaced by "little."

Comment 10: It is not unreasonable to think that a family would want to move away from a tailings operation even if the water quality was not jeopardized. (P-10(H1).4)

Response: EPA has established these standards to insure reasonable protection of public health. We agree that there may be other considerations that govern the choice of location of a residence, or that some may not agree with our judgements on the adequacy of protection provided by these standards. For this reason we have been as explicit as possible in describing the protection provided.

Comment 11: In addressing active milling sites, EPA should also have stated that all but two of the inactive tailings sites in the State of Colorado are under current specific licenses. The two that are not under licenses have been determined to have met the general license provisions of the Colorado regulations. (S-12(H2).11)

Response: We are happy to have this information for the record, but it does not apply to this rulemaking.

Comment 12: As provided by UMTRCA, states can have more stringent, not less stringent, standards than those promulgated by EPA and the NRC. (S-12(H2).12)

Response: We agree.

Comment 13: Any person living near a tailings pond should have the right to have a survey done of his residence to see if the levels inside of that residence are safe. (S-3(H2.5)

Response: These standards do not preclude such an action in any way.

Comment 14: Low-priority sites, such as those on the Navajo Reservation, must not be simply fenced; they must be removed and buried. (P-6(2).3)

Response: EPA does not specify the method for complying with its standards. Although removal and burial is one possible means of compliance, there are others. (The reference to "priority" evidently relates to remedial actions for inactive sites under Title I of UMTRCA.)

Comment 15: Technology does not currently exist to meet the proposed standards. (P-8(H1).26, P-40.4)

Response: The comment is incorrect. The FEIS describes a variety of measures available to achieve compliance.

Comment 16: Promulgation of the standards should be delayed until EPA authorizes an independent study to evaluate the environmental and public health impacts of mill tailings. (I-22.6)

Response: Congress has directed EPA to promulgate these standards by October 1, 1983. In any case, we do not agree that such a study is needed to establish a basis for standards.

Comment 17: Industry's proposal (non-arid regions case) regarding management of their tailings impoundments, is to use the low-level storage method, with trench capacity for seven and eight months supply of mine tailings. My concerns: What happens to these tailings in the interim period of seven and eight months, in the interim period of total reclamation? Where can we find total reclamation? (P-10(H1).1)

Response: Regarding the risk from tailings during the predisposal period, see the FEIS and Section 4 of these comments. Regarding reclamation, that objective is not a part of EPA's authorization under UMTRCA, which addresses the areas of public health, safety, and environmental protection.

Comment 18: EPA suggests that reducing water inventories on the piles can have beneficial effects. It must be recognized that such water reductions can result in the release of extra radon from the sites. (I-27.3)

Response: We recognize that excessive removal of water could permit piles to dry out and increase this release of radon during operations. We meant that water should be minimized during operations only to the extent compatible with radon control so as to reduce the potential for groundwater contamination.

Comment 19: We support the New Mexico Legislative Radioactive Materials Committee's resolution. (P-48.1)

Response: The comment is noted. (EPA's standards are more protective than those the comment supports. They require greater longevity of control and lower radon releases after disposal.)

Comment 20: Please consider the fact that tobacco is very sensitive to air and water pollution. Uranium mining in Virginia could affect this crop. (P-50.1)

Response: The basis for our water protection standards is nondegradation. We have not identified any effects of airborne radioactivity on tobacco that applies in the context of these standards.

Comment 21: We urge you to reject the recommendations of Governor Toney Anaya (New Mexico) concerning the proposed regulations. (P-29(2).1, P-29(3).1)

Response: The comment is noted. (The comment refers to Submittal S-11.)

B. 40 CFR PART 192, SUBPART E - STANDARDS FOR THORIUM BYPRODUCT MATERIALS

In commenting, many of the respondents did not specifically differentiate between uranium and thorium standards, although "thorium" may have been part of their statement. Thus, many of the comments summarized in Part A could be added to Part B; however, this was deemed redundant and was not done. Only comments specifically addressing issues on thorium were included in Part B.

B.1.0 SCOPE OF THE STANDARDS, THE DEIS, AND THE RIA

B.1.1 Coverage of the Standards, the DEIS, and the RIA

Comment 1: Since the only facility affected by the proposed standard has already developed a comprehensive decommissioning plan, and NRC has already issued a FEIS, the proposed standard amounts to duplicative regulation that will only complicate, confuse, and delay final decommissioning. This is not in the public interest. The proposed standards should be withdrawn. (I-6(H2).22, I-6(3).87, I-6(4).1)

Response: Under UMTRCA, EPA has the responsibility for setting health and environmental protection standards for thorium mill tailings. EPA does not believe that it can properly satisfy this general responsibility through a specific determination by another agency on a single action. Several other sites listed in Chapter I of the FEIS are potentially subject to this regulation, as would any thorium mills that may be operated in the future.

Comment 2: Section 192.41 appears to provide for identical treatment of uranium tailings and thorium tailings, while the quoted language from the Supplementary Information suggests that some similar but not identical standards have been proposed for thorium tailings. Please clarify. (S-5.2, S-5.1)

Response: We mean to have identical provisions for uranium and thorium tailings with the specific modifications for thorium indicated in 192.41, subparagraphs (a)-(d). Because of these changes, the provisions are not identical. We previously referred to the thorium tailings standards as "derived from and comparable to" the standards for uranium tailings. We might add that they also include the standards for uranium tailings. See the response to Comment 5, B.1.1.

Comment 3: Please leave in paragraph 3, column 1, pg. 19591. This is the best explanation for the thorium situation in the proposed rule. (P-2.4)

Response: This material is on record in the FR notice mentioned. Repetition is not necessary.

Comment 4: If EPA decides to retain its proposed standards, it should exempt Kerr-McGee's West Chicago Facility. (I-6(4).5)

Response: The commenter suggests no basis upon which EPA could reasonably exempt the West Chicago facility from the general rule. The imminence of a plan to stabilize waste would seem to be the sort of circumstance that warrants evaluation in light of the standards Congress has required. Also see the response to Comment 1, B.1.1.

Comment 5: EPA does not indicate if the different isotopes (for example radon-222 and radon-220) should be treated completely independently or whether they should be combined. Since some uranium mines also have thorium in the tailings it would seem appropriate to combine the isotopes because they can produce combined health effects. (I-29.6)

Response: EPA believes that the final standards for thorium wastes need to include the provisions for uranium wastes, because there may be sufficient uranium decay products present in thorium wastes as to constitute a hazard if not explicitly addressed. We believe the converse requirement (i.e., incorporating thorium standards explicitly in the uranium standards) is not needed, however. The final standards have been written accordingly.

B.1.2 Definitions

Comment 1: Does Section 192.41(a) add thorium to the list of hazardous constituents in 40 CFR 264.94? If not, thorium should be added. (S-5.4)

Response: Section 192.41 states that provisions applicable to uranium shall apply to thorium. This applicability extends to the designation of uranium as a hazardous constituent, so that thorium is also so designated for purposes of UMTRCA only. Neither uranium nor thorium are added to Appendix VIII, Hazardous Constituents of Part 261.

B.1.3 Responsibilities of the EPA and the NRC

Comment 1: EPA has, in effect, turned over the thorium standards to the NRC. EPA should remain involved in the standards setting process (P-2.7)

Response: EPA has two obligations in setting these standards. One is to retain primary responsibility for setting standards for health and environmental protection. The other is to minimize administrative and regulatory burdens resulting from the responsibilities that UMTRCA assigned to EPA and NRC. We believe we have fairly balanced these obligations. Note that there is an EPA concurrence requirement for any substitute provisions under Section 192.42.

Comment 2: EPA's proposal to retain authority over variances to SWDA numerical standards is an unwarranted and illegal intrusion into site-specific licensing decisions. (I-6(3).9, I-6(3).85, I-6(4).6)

Response: See the response to Comment 25, A.1.4.

B.2.0 RISK ASSESSMENT

B.2.1 Radiological Health Risk Assessment

Comment 1: Appropriate comments on the risks from thorium tailings emission as well as uranium tailings emission should be made, even though the EPA states that the best measurement for thorium emission is a rough calculation. (P-2.3)

Response: Appendix G, which evaluates the potential risk from a thorium tailings pile, has been added to the FEIS.

Comment 2: EPA has failed to demonstrate any health effect attributable to thorium or its decay products at high background levels. (I-6(3).81)

Response: As pointed out in the response to Comment 8, A.2.1, it has been estimated that millions to hundreds of millions of person years of observation with good vital statistics data, would be required before one could hope to demonstrate the effects of continuous exposure to about 4 times normal background radiation. It is not unexpected that increased cancer has not been demonstrated. We do not now have the technical ability to prove or disapprove the hypothesis given the numbers of persons exposed and the level of exposure.

The Kerala region of India has a population of about 70,000 with an estimated average exposure of about 342 mrem/yr, even though a small fraction (3105 persons) is exposed to 915 mrem/yr (C.M. Sunta, et al., TLD Survey of Natural Radiation Environmental Along the South-West Coast of India, Bhabha Atomic Research Centre, Bombay, 1978). While the commenter cites Gopal-Ayengar, et al. (p.117) as showing no effects in Kerala, he does not mention positive reports by Kochupillai, et al. (N. Kochupillai, et al, Nature 262: 60-61, 1976) on increased congenital abnormalities, nor reproductive problems in 22 couples at about 20 times background (Sunta, et al. 1978).

Likewise in the Brazilian study group, a 1970 report by Cullen, et al, is referenced but not a 1975 report by Costa-Ribeiro, et al, (C. Costa-Ribeiro, et al. Health Physics, 28: 225-232, 1975) showing increased chromosome aberrations in cytogenetic studies of lymphocytes of workers in a monazite plant. No reports on cancer incidence in the exposed Brazilian population are expected. A recent report by the Brazilian investigators (T. L. Cullen, et al pp. 805-808 in Radiation Protection A Systematic Approach to Safety, 5th IRPA Congress, Pergamon Press, NY, 1980) concluded, "The lack of reliable medical practice and records renders an epidemiological study impractical".

Finally the commenter referenced the High Background Radiation Research Group in China. This study was updated in 1981 (J. Radiat., Res. 22: 88-100, 1981). This update reported 383,653 person years and 418,265 person years in the cancer mortality study in the high-background and control groups respectively. Since exposure in the high-background area was about 3 times that in the control area, it should not be expected that an increase in radiation-related cancer would be demonstrated if present. Cytogenetic studies showed an increase in two-hit aberrations, the type one might expect to be associated with high-LET radiation, in the high background study group. However, the total number of cases is small and the significance is not known.

About all that can be said of the high background area studies is, they can't answer our questions. They do show we are not underestimating risk by orders of magnitude.

Comment 3: Epidemiological studies of thorium workers and people exposed to high background levels of thorium have not found any evidence of adverse health effects. This indicates that thorium and thorium wastes at the levels involved at thorium sites do not present a special radiological hazard. (I-6(3).81)

Response: See the response to Comment 2, B.2.1.

B.3.0 RATIONALE FOR STANDARDS

B.3.1 Basis for Standards

Comment 1: We support reasonable, cost-effective and scientifically based regulation of thorium milling facilities. (I-6(3).1)

Response: We agree. EPA has, to the best of its ability, made its thorium standards reasonable and cost-effective, and has based them on the best available scientific evidence.

Comment 2: We oppose EPA's proposal of standards for thorium tailings without explanation or analysis of the one site to which they will be applicable. This failure deprives us of our right to provide meaningful comments and makes the proposal unlawful. (I-6(3).13, I-6(3).80, I-6(H2).21, I-6(4).2)

Response: EPA has considered the Kerr-McGee site in West Chicago(*) in developing Appendix G of the FEIS, Volume I. EPA chose to analyze a model thorium tailings pile with the same basic specifications as its model uranium tailings pile. Section G.2 (Tailings Piles) of Appendix G of the FEIS gives the reasons for this choice. Also see the response to Comments 1 and 4, B.1.1.

(*)Ref: Kerr-McGee Chemical Corp., "Plan for Decommissioning the Factory Site and Stabilizing Under License the Disposal Site of the Kerr-McGee West Chicago Rare Earths Facility," Kerr-McGee Chemical Corp., 1979.

Comment 3: The EPA's rules under the UMTRC Act will, in part, govern the pending NRC proceeding involving a firm's plans to operate a thorium milling operation in West Chicago. Therefore, the EPA should clarify whether the proposed Part 192 applies to disposal in nonarid regions. (S-5.11)

Response: Part 192 applies to both arid and nonarid regions. We have made changes in Section 192.32(a)(1) that detail the requirements for nonarid sites.

Comment 4: Management of thorium tailings during processing and after closure should not differ from management of uranium tailings since the hazards associated with the tailings are similar in all pertinent respects to those associated with uranium tailings. (S-5.3)

Response: We agree. See the response to Comment 5, B.1.1.

Comment 5: The simple difference in decay times of Rn-222 vs. Rn-220, the level of research activity, standards studies, and lack of administrative concern all confirm the paucity of evidence that thorium standards should be numerically equivalent to uranium standards. (P-2.2)

Response: See the response to Comment 2, B.3.1.

Comment 6: EPA's proposed standards for thorium are arbitrary in that they ignore radiological and biological differences between thorium and its daughters and uranium and its daughters. Although the risk from thorium is much smaller than from uranium, this difference is ignored in the proposed standards. (I-6(3).82, I-6(4).3)

Response: We do not agree that risks from thorium mill tailings are much less than those from uranium mill tailings. Our analysis, in Appendix G of the FEIS, indicates that risks from thorium mill tailings are reasonably comparable to those from uranium mill tailings, and that the same numerical standards are appropriate.

Comment 7: We note that in the proposed standards in Subpart E the same numerical standards are proposed for radon-220 and radium-228 in the thorium series as for radon-222 and radium-226, respectively, in the uranium series. It is not technically correct to use the numerical standards derived for uranium daughters for the daughters of thorium because of differing decay times and modes. From the properties of radon-220 and its daughters, we would expect the standard for radon-220 to be significantly less restrictive than that for radon-222. For radium-228, because of its short half-life, we would also expect the standard to be less restrictive than that for radium-226. (F-5(3).11)

Response: The risks from radon-220 emissions from a tailings pile are comparable to those from radon-222 emissions, when the much larger source term radon-220 is taken into account. See Appendix G of the FEIS. The effects of radium-228 in water are about the same as those of radium-226 as reflected in the National Interim Primary Drinking Water Regulations. Also, see the response to Comment 5, B.1.1.

B.4.0 STANDARDS FOR OPERATIONS

Comment 1: Your references to existing standards, rather than developing new numerical values, is desirable. However, do not forget to include thorium when developing these regulations. (P-2.4)

Response: Section 192.41 applies all the standards to thorium byproduct material.

B.4.1 Design and Operating Requirements for Surface Impoundments

Comment 1: We agree with EPA's decision to allow continued use of existing tailings systems so long as groundwater standards are met. (I-6(3).3)

Response: No reply needed.

Comment 2: Since cleanup of the only thorium tailings site will involve mining tailings with pond sediment and other wastes, these could be construed as new tailings subject to a liner requirement. Such a liner would create a bathtub effect which is clearly undesirable. Liner and cap requirements should be left to the implementing agency. (I-6(3).83, I-6(4).4)

Response: If tailings containing thorium residues are moved to a new impoundment, they would be subject to the regulations. Section 192.32(a)(1) would apply, subject to Subpart E. Section 192.32(a)(i) is explicitly designed to avoid the "bathtub" effect.

B.4.2 Groundwater Protection

B.4.2.1 Standards (40 CFR 264.92)

Comment 1: EPA's proposal to apply SWDA requirements to thorium tailings is unsupported and unnecessary. (I-6(3).84)

Response: The nonradiological impact of thorium mill tailings on groundwater would be expected to be similar to that from uranium mill tailings. The SWDA requirements are relevant not by virtue of the nature of thorium, but by virtue of the statutory requirement that the standards for nonradioactive hazards be consistent with those of Subtitle C.

B.4.2.2 Hazardous Constituents (40 CFR 264.93)

Comment 1: If it is not already the intent of the EPA, then thorium should be added to the list of hazardous constituents under 40 CFR 264.94. (S-5.4)

Response: Thorium is listed as a hazardous constituent for purposes of UMTRCA only. Thorium is not added to Appendix VIII of Section 261 by this action. See the response to Comment 1, B.1.2.

B.4.2.3 Concentration Limits (40 CFR 264.94)

Comment 1: We do not support EPA's proposed concentration limits for certain substances (e.g., selenium) in groundwater affected by thorium tailings. (I-6(3).7)

Response: Under the SWDA as amended, selenium and other constituents found in tailings are classified as hazardous. This was done after extensive rulemaking procedures. These UMTRCA standards are required to be consistent with the Subtitle C standards issued under the SWDA for nonradiological hazards from tailings. We have no reason to believe that selenium as a constituent of thorium wastes is any less hazardous than as a constituent of wastes regulated under the SWDA.

B.4.3 Surface Water Protection (40 CFR 440)

Comment 1: We oppose EPA's application of Clean Water Act standards to thorium mills. (I-6(3).12)

Response: These UMTRCA standards for effluents from thorium mills require the control of COD, zinc, radium-226, radium-228, uranium, thorium, pH, and TSS for new sources if the precipitation exceeds the evaporation at any site; the standards require control of TSS, COD, arsenic, zinc, radium-226, radium-228, ammonia, and pH for existing sources. Since the only difference between Subpart D and Subpart E is the addition of requirements for thorium for new sources, we believe application of the effluent guidelines imposes no unreasonable burden on the industry, especially since thorium is easily controlled.

B.4.4 Control of Radon Releases

Comment 1: We agree with EPA's decision to retain the radon/radon decay product release limits in 10 CFR 20, Appendix B, during the operational period. (I-6(3).2)

Response: See the response to Comment 10, A.4.4.

B.5.0 STANDARDS FOR DISPOSAL

Comment 1: We do not support EPA's proposal to require 10 feet of cover on tailings piles. (I-6(3).5)

Response: The rule does not specify any particular thickness of cover on tailings piles. For any specific case, the thickness will depend on the need to satisfy the longevity requirement while maintaining emission rate limits for radon-220 and radon-222 of 20 pCi/m^2-sec.

B.5.1 Period of Effectiveness

Comment 1: We agree with EPA's proposal to require maintenance-free stabilization of tailings for 200 years. (I-6(3).4)

Response: See the response to Comment 1, A.5.1.

B.6.0 MISCELLANEOUS COMMENTS

Comment 1: Some clear recognition that uranium tailings dominate the proposed standards is in order. Some reference to this fact should be found in the title, the summary, or the introduction to the regulations. (P-2.1)

Response: We do not agree that uranium tailings dominate the proposed standards. The standards regulate both uranium and thorium milling operations, both existing and future. It is true that there is (and has been) much more uranium milling than thorium milling. We do not know whether this situation will continue in the future. The standards are neutral on this point.

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY				
P-1(1)	3	6-01-83	Southwest Research and Information Center (New Mexico)	5-11-83
P-1(2)	97	7-5-83	Southwest Research and Information Center	6-30-83
P-2	4	6-01-83	James G. Terrill, Jr. and Associates	5-25-83
P-3(1)	8	6-06-83	Technical Information Project	ND
P-3(2)	45	6-16-83	Technical Information Project	6-11-83
P-4(1)	18	6-06-83	Environmental Policy Institute	5-18-83
P-4(2)	36	6-08-83	Environmental Policy Institute	5-18-83
P-4(3)	80	6-30-83	Environmental Policy Institute	6-30-83
P-4(4)	146	7-25-83	Environmental Policy Institute	7-19-83
P-5(1)	25	6-06-83	Piedmont Environmental Council	5-20-83
P-5(2)	37	6-08-83	Piedmont Environmental Council	5-18-83
P-5(3)	53	6-28-83	Piedmont Environmental Council	6-22-83
P-6(1)	26	6-06-83	Phaedra Levy, Taos Environmental Assn.	5-28-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY (Continued)				
P-6(2)	74	6-30-83	Kathryn McElmur Taos Environmental Assn.	6-28-83
P-7	27	6-07-83	Cornell University, Lab. of Atomic and Solid State Physics	5-17-83
P-8	35	6-08-83	Eloise F. Nenon, Chatham, VA for Southside Concerned Citizens	5-19-83
P-9(2)	50	6-02-83	National Council on Radiation Protection and Measurements	5-31-83
P-9(3)	82	6-30-83	National Council on Radiation Protection and Measurements	6-30-83
P-11	47	6-21-83	Center for Alternative Mining Development Policy	6-15-83
P-12	48	6-22-83	University of Colorado	6-16-83
P-13(1)	51	6-23-83	Radiation Education Council	5-26-83
P-13(2)	56	6-28-83	Radiation Education Council	6-24-83
P-16(1)	109	7-05-83	R. Young, Rocky Mountain Chapter Sierra Club and Colorado Open Space Council	6-27-83
P-23	52	6-24-83	Rocky Mountain Greenpeace	ND
P-24	54	6-28-83	R.C. Kalom, Taos, NM	6-23-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
			COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY (Continued)	
P-25	55	6-28-83	Virginia Reynolds, El Prado, NM	6-23-83
P-26	57	6-28-83	Eagle Rock Committee for Survival	6-22-83
P-27	63	6-30-83	City of Grants (New Mexico)	6-28-83
P-28	64	6-30-83	New Mexicans for Jobs & Energy	6-29-83
P-29(1)	65	6-30-83	Americans for Rational Energy Alternatives, Inc.	6-24-83
P-29(2)	130	7-11-83	Americans for Rational Energy Alternatives, Inc.	6-30-83
P-29(3)	140	7-14-83	Americans for Rational Energy Alternatives, Inc.	6-30-83
P-30	67	6-30-83	Carl J. Johnson	6-15-83
P-31(1)	68	6-30-83	University of New Mexico School of Medicine	6-27-83
P-31(2)	129	7-11-83	University of New Mexico, School of Medicine	6-27-83
P-32	70	6-30-83	Environmental Coalition on Nuclear Power	6-28-83
P-33	71	6-30-83	Solar Lobby	6-30-83
P-34	72	6-30-83	Western Colorado Congress	6-27-83
P-35	73	6-30-83	Friends of the Earth	6-27-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY (Continued)				
P-36	75	6-30-83	Bruce Martin	6-26-83
P-37	76	6-30-83	Alan B. Goodman	6-28-83
P-38	89	7-01-83	Mrs. Frederic W. Scott	6-17-83
P-39	90	7-01-83	Timothy M. Michel	6-17-83
P-40	91	7-01-83	Donald J. Walsh	6-17-83
P-41	95	7-01-83	Joseph K. Wagoner, Springfield, VA	ND
P-42	100	7-05-83	Hugh and Virginia Bowers, Sutherlin, VA	6-23-83
P-43	101	7-05-83	Colonel David Foster, Gordonsville, VA	6-24-83
P-44	103	7-05-83	Ministry of Concern for Public Health	6-29-83
P-45(1)	104	7-05-83	Environmental Defense Fund	6-30-83
P-45(2)	126	7-11-83	Environmental Defense Fund	7-01-83
P-46	107	7-05-83	Dr. A. Mangalik, Albuquerque, NM	6-27-83
P-47	108	7-05-83	Daniel Kelinsky, M.D., Albuquerque, NM	6-28-83
P-48	112	7-11-83	Letter to W. Ruckelshaus from 33 individuals from New Mexico	6-27-83
P-49	113	7-11-83	Comments on Behalf of the Navajo Nation	6-30-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
		COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY (Continued)		
P-50	114	7-11-83	Joanne Spangler, Danville, VA	ND
P-51	116	7-11-83	Janet Donavant, Martinsville, VA	ND
P-52	117	7-11-83	Steve and Brenda Reynolds, Chatham, VA	6-26-83
P-53	118	7-11-83	Mr. and Mrs. John Cole, Chatham, VA	6-27-83
P-54	119	7-11-83	Linda Calhoun, Chesapeake, VA	6-26-83
P-55	121	7-11-83	Wyatt and J'nene Oakes, Chatham, VA	ND
P-56	122	7-11-83	Mary Levy, New Canton, VA	6-25-83
P-57	123	7-11-83	Sam and Elma Reynolds, Chatham, VA	ND
P-58	124	7-11-83	Hattie Cooke, Martinsville, VA	6-29-83
P-59	125	7-11-83	Northwest Environmental Preservation Committee	6-27-83
P-60	128	7-11-83	Dan Kenlensky, M.D.	ND
P-61	131	7-11-83	Barbara Lambert, Rochelle, VA	6-25-83
P-62	132	7-11-83	Carol Bratton, Rochelle, VA	6-26-83
P-63	133	7-11-83	Belva Sours Uppercue, Portland, ME	6-27-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
			COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY (Continued)	
P-64	134	7-11-83	Kathleen Hayden, Martinsville, VA	6-27-83
P-65	139	7-14-83	Pennsylvania Public Interest Coalition	7-01-83
P-66	142	7-25-83	Mrs. David Flick, Blairs, VA	7-21-83
P-67	143	7-25-83	Donald Ober Real Estate, Orange, VA	7-22-83
P-68	144	7-25-83	William Winn, Martinsville, VA	7-21-83
P-69	147	7-26-83	Angus Wyman MacDonald	7-21-83
P-70	152	8-06-83	Letter from the Mayor of Gallup, NM. (Same letter as IV-D-112)	6-27-83
P-71	155	8-15-83	Katharine Fitzerald	6-24-83
P-72	156	8-15-83	Karl Z. Morgan	8-01-83
			COMMENTS FROM INDUSTRY	
I-1(1)	IV-D-1	5-13-83	Western Nuclear, Inc.	5-04-83
I-1(2)	61	6-29-83	Western Nuclear, Inc.	6-28-83
I-2(2)	2	5-13-83	Rocky Mountain Energy Co.	5-10-83
I-2(2)	62	6-29-83	Rocky Mountain Energy Co.	6-28-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
		COMMENTS FROM INDUSTRY (Continued)		
I-3(1)	9	6-06-83	UNC Mining and Milling	5-05-83
I-3(2)	85	6-30-83	United Nuclear Corp. (submitted by Stephenson, Carpenter...)	6-29-83
I-4(1)	10	6-06-83	American Mining Congress	5-06-83
I-4(2)	38	6-08-83	American Mining Congress	6-03-83
I-4(3)	87	6-30-83	American Mining Congress Comments with 9 volumes of Appendices	6-30-83
I-5(1)	12	6-06-83	Shaw, Pittman, Potts & Trowbridge for Atlas Corp.	5-10-83
I-5(2)	88	7-01-83	Atlas Corp. (submitted by Shaw, Pittman...)	6-30-83
I-6(1)	15	6-06-83	Kerr-McGee Corp. (submitted by Covington and Burling)	5-16-83
I-6(2)	31	6-08-83	Kerr-McGee Corp. (submitted by Covington and Burling)	5-20-83
I-6(3)	40	6-13-83	Kerr-McGee Corp., et al (with Appendices)	6-14-83
I-6(4)	86	6-30-83	Kerr-McGee Corp., et al.	6-30-83
I-7(1)	16	6-06-83	Homestake Mining Co.	5-16-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
		COMMENTS FROM INDUSTRY (Continued)		
I-7(2)	79	6-30-83	Homestake Mining Co. (testimony of George V. Sabol submitted by Stephenson, Carpenter...)	6-29-83
I-7(2)	84	6-30-83	Homestake Mining Co. (submitted by Stephenson, Carpenter...)	6-29-83
I-8	17	6-06-83	Exxon Minerals Co.	5-17-83
I-9(1)	19	6-06-83	Anaconda Minerals Corp.	5-20-83
I-9(2)	105	7-05-83	Anaconda Minerals Corp.	6-24-83
I-10(1)	20	6-06-83	Newmont Mining Corp.	5-20-83
I-10(2)	83	6-30-83	Newmont Mining Corp.	6-30-83
I-10(3)	94	7-01-83	Dawn Mining Co. (Subsidiary of Newmont Mining Corp.)	6-30-83
I-11(1)	21	6-06-83	Rio Algom Corp.	5-16-83
I-11(2)	46	6-16-83	Rio Algom Corp., Lisbon Mine	6-13-83
I-12(1)	22	6-06-83	Conoco Inc.	5-20-83
I-12(2)	110	7-08-83	Conoco Inc.	6-29-83
I-13(1)	23	6-06-83	Colorado Mining Assn.	5-24-83
I-13(2)	136	7-12-83	Colorado Mining Assn.	7-06-83
I-14(1)	24	6-06-83	Union Carbide Corp.	5-24-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
		COMMENTS FROM INDUSTRY (Continued)		
I-14(2)	148	7-27-83	Union Carbide Corp.	7-22-83
I-15(1)	28	6-07-83	Chevron Resources Co.	5-27-83
I-15(2)	127	7-11-83	Chevron Resources Co.	6-29-83
I-16(1)	29	6-08-83	Schlegel Corp.	5-16-83
I-16(2)	60	6-29-83	Schlegel Corp.	6-22-83
I-16(3)	99	7-05-83	Schlegel Lining Technology, Inc.	6-27-83
I-17	30	6-08-83	Amax Inc.	5-19-83
I-18	32	6-08-83	Climax Molybdenum Co.	5-25-83
I-19	42	6-14-83	Marline Uranium Corp. (submitted by Shaw et al.)	6-14-83
I-20	43	6-15-83	Pathfinder Mines Corp.	6-13-83
I-21	49	6-23-83	Minitome	6-15-83
I-22	69	6-30-83	Atomic Industrial Forum	6-30-83
I-23	78	6-30-83	Silver King Mines, Inc.	6-27-83
I-24	81	6-30-83	The Fertilizer Institute	6-30-83
I-25	92	7-01-83	Cotter Corp.	6-29-83
I-26	93	7-01-83	Ebasco Services, Inc.	6-27-83
I-27	102	7-05-83	Envirologic Systems, Inc.	6-27-83
I-28	58	6-28-83	Wyoming Mining Assn.	6-24-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
COMMENTS FROM INDUSTRY (Continued)				
I-29	59	6-29-83	Terradex Corp.	5-27-83
I-30	66	6-30-83	Getty Oil Co.	6-28-83
I-31	111	7-08-83	Simplot Co.	6-30-83
I-32	153	8-08-83	Gunderson Oil Company	6-27-83
COMMENTS FROM FEDERAL AGENCIES				
F-1	6	6-02-83	U.S. Dept. of Interior	5-31-83
F-2	7	6-02-83	U.S. Dept. of Health and Human Services	5-27-83
F-3(1)	13	6-06-83	Tennessee Valley Authority	5-10-83
F-3(2)	44	6-15-83	Tennessee Valley Authority	6-10-83
F-4(1)	14	6-06-83	U.S.H.R., Committee on Interior and Insular Affairs, M. Udall, Chairman	5-11-83
F-4(2)	151	7-25-83	U.S.H.R., Committee on Interior and Insular Affairs, M. Udall, Chairman	7-22-83
F-4(3)	157	8-15-83	U.S.H.R., Committee on Interior and Insular Affairs, M. Udall, Chairman. Letter to Nunzio Palladino, Chairman NRC	6-27-83
F-5(1)	34	6-08-83	U.S. Dept. of Energy	5-25-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
		COMMENTS FROM FEDERAL AGENCIES (Continued)		
F-5(2)	94	7-01-83	U.S. Dept. of Energy	6-30-83
F-5(3)	115	7-11-83	U.S. Dept. of Energy	6-30-83
F-6(1)	106	7-05-83	John F. Ahearne of the U.S. Nuclear Regulatory Commission (Personal views)	6-29-83
F-6(2)	137	7-12-83	U.S. Nuclear Regulatory Commission	6-08-83
F-6(3)	138	7-12-83	U.S. Nuclear Regulatory Commission, enclosing responses to NRC's proposed suspension of selected provisions of the Commission's mill tailings regulations.	6-08-83
F-7	154	8-09-83	U.S. Senators Pete Domenici and Alan K. Simpson. Letter to Nunzio Palladino, Chairman NRC	7-25-83
F-4(4)	164	8-25-83	M. Udall, Chairman, U.S.H.R. Committee on Interior and Insular Affairs	8-10-83
F-8(1)	158	8-22-83	U.S.H.R., Committee on Armed Services, S.S. Stratton, Chairman, Subcommittee on Procurement and Military Nuclear Systems	6-28-83
F-8(2)	160	8-25-83	U.S.H.R., Committee on Armed Services	3-18-83
F-9	159	8-24-83	Office of Management and Budget	

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
		COMMENTS FROM STATE AND LOCAL GOVERNMENTS		
S-1	5	6-02-83	South Dakota Dept. of Water and Natural Resources	5-27-83
S-2	11	6-06-83	State of Wyoming, Office of the Attorney General	5-10-83
S-3(1)	33	6-08-83	Wyoming Dept. of Environmental Quality	6-01-83
S-3(2)	98	7-05-83	Wyoming Dept. of Environmental Quality	6-27-83
S-4(1)	39	6-08-83	Commonwealth of Virginia Office of the Governor	5-26-83
S-4(2)	141	7-22-83	Commonwealth of Virginia, Council of the Environment	7-18-83
S-5	41	6-14-83	State of Illinois, Attorney General	6-09-83
S-6	77	6-30-83	Washington State Dept. of Social and Health Services	6-28-83
S-7	120	7-11-83	Halifax County, VA, Planning Commission	6-27-83
S-8	135	7-12-83	Sheriff of Cibola County, NM (submitted by Stephenson, Carpenter...)	7-06-83
S-9	145	7-25-83	State of New Mexico Legislative Council	7-05-83

TABLE C-1
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	DOCKET NUMBER	DATE RECEIVED AT CENTRAL DOCKET SECTION	COMMENTER	DATE OF DOCUMENT
		COMMENTS FROM STATE AND LOCAL GOVERNMENTS (Continued)		
S-10	149	8-01-83	State of New Mexico Office of the Governor	7-18-83
S-11(1)	150	8-01-83	Louise Yellowman-- Coconino County, Supervisor	7-25-83
S-11(2)	163	8-25-83	States of Colorado and New Mexico; Sen. Gary Hart, Colorado; Gov. Richard D. Lamm, Colorado; Gov. Toney Anaya, New Mexico	7-08-83

TABLE C-2
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	COMMENTER
	TESTIMONY PRESENTED AT PUBLIC HEARINGS WASHINGTON, D.C. (May 31, 1983)
	COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY
P-4(H1)	David M. Berick for Environmental Policy Inst.
P-5(H1)	G. H. Herbert for Piedmont Environmental Council
P-8(H1)	Eloise Nenon
P-9(H1)	W. K. Sinclair for NCRP
P-10(H1)	Sarah A. Motley

TABLE C-2
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	COMMENTER	DATE OF HEARING
	TESTIMONY PRESENTED AT PUBLIC HEARINGS DENVER, COLORADO (H2)	
	COMMENTS FROM MEMBERS OF THE PUBLIC, PUBLIC INTEREST GROUPS, AND THE SCIENTIFIC COMMUNITY	
P-1(H2-1)	Chris Shuey, for Southwest Research and Information Center	6-15-83
P-1(H2-2)	Linda Taylor, for Southwest Research and Information Center	6-15-83
P-14(H2)	Grant Parker, for Powder River Resource Council	6-15-83
P-15(H2)	Joseph Pierce, for Two Rivers Citizens Association	6-15-83
P-16(H2)	Dennis Eberl, University of Illinois	6-15-83
P-17(H2)	Roy Young, for The Sierra Club	6-15-83
P-18(H2)	Robert Fried, M.D.	6-15-83
P-19(H2)	Dr. Edward Martell, for National Center for Atmospheric Research	6-16-83
P-20(H2)	Albert Hazle, for the Conference of Radiation Control Program Directors	6-16-83
P-21(H2)	Ray Junge	6-16-83
P-22(H2)	Luke Danielson, for National Wildlife Federation	6-16-83

TABLE C-2
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	COMMENTER	DATE OF HEARING
	TESTIMONY PRESENTED AT PUBLIC HEARINGS DENVER, COLORADO (H2)	
	COMMENTS FROM INDUSTRY	
I-4(H2)	Robert Beverly, for American Mining Congress	6-16-83
I-6(H2-1)	George Rice, for Kerr-McGee Corporation	6-15-83
I-6(H2-2)	Dr. Donald Runnells, for Kerr-McGee Corporation	6-15-83
I-6(H2-3)	Charles Montagne, for Kerr-McGee Corporation	6-15-83
I-16(H2-1)	James Price, for Schlegel Corporation	6-15-83
I-16(H2-2)	Joyce Underberg, Schlegel Corporation	6-15-83
I-18(H2)	James Gilleland, for Climax Molybdenum Company	6-15-83
	COMMENTS FROM FEDERAL AGENCIES	
F-5(H2-1)	Mark Mathews, for U.S. Dept. of Energy	6-15-83
F-5(H2-2)	Vern Rogers, for U.S. Dept. of Energy	6-15-83
F-5(H2-3)	John Nelson, for U.S. Dept. of Energy	6-15-83
F-5(H2-4)	Dr. Tom Shephard, for U.S. Dept. of Energy	6-15-83

TABLE C-2
WRITTEN SUBMITTALS

DOCKET A-82-26

CATEGORY IV-D

AFFILIATION & SUBMITTAL CODE	COMMENTER	
	COMMENTS FROM STATE AND LOCAL GOVERNMENTS	
S-3(H2)	Gary Beach, for Department of Environmental Quality, State of Wyoming	6-15-83
S-12(H2)	Warren Jacobi, Department of Health, State of Colorado	6-16-83
S-13(H2)	Jerry Stewart, Uranium Licensing Section, State of New Mexico	6-16-83

TECHNICAL REPORT DATA

(Please read Instructions on the reverse before completing)

1. REPORT NO. EPA Report 520/1-83-008-1	2.	3. RECIPIENT'S ACCESSION NO.
4. TITLE AND SUBTITLE Final Environmental Impact Statement for Standards for the Control of Byproduct Materials from Uranium Ore Processing (40 CFR 192)		5. REPORT DATE September 1983 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) U.S. Environmental Protection Agency Office of Radiation Programs (ANR-460), Washington, D.C.		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS		13. TYPE OF REPORT AND PERIOD COVERED 14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

The Environmental Protection Agency has issued health and environmental protection standards for the control of uranium and thorium tailings during ore processing operations and for final disposal. These standards will apply to tailings licensed by the U.S. Nuclear Regulatory Commission and the States under Title II of the Uranium Mill Tailings Radiation Control Act of 1978 (Public Law 95-604). This Final Environmental Impact Statement examines health, environmental, technical. and cost considerations and other factors important to developing the standards.

Volume II of this document contains the Agency responses to comments received as a result of the public review that is part of the regulatory process.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
uranium mill tailings radioactive waste disposal radon radium thorium hazardous constituents Uranium Mill Tailings Radiation Control Act Resource Conservation and Recovery Act		

18. DISTRIBUTION STATEMENT Release Unlimited	19. SECURITY CLASS *(This Report)* Unclassified	21. NO. OF PAGES
	20. SECURITY CLASS *(This page)* Unclassified	22. PRICE

EPA Form 2220-1 (Rev. 4-77) PREVIOUS EDITION IS OBSOLETE